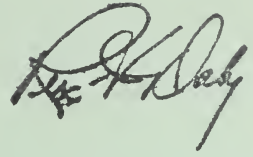


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LAND and WATER RESOURCES

A POLICY GUIDE

UNITED STATES DEPARTMENT OF AGRICULTURE
Washington, D.C.

May 1962

Slightly revised September 1962

**United States
Department of
Agriculture**



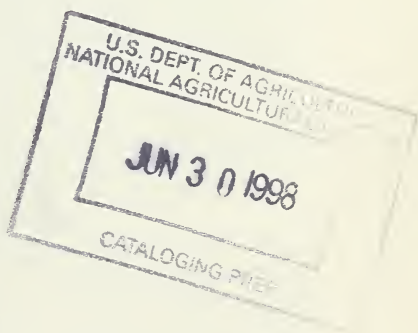
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LAND and WATER RESOURCES

A POLICY GUIDE



Growth Through Agricultural Progress



1930

Foreword

This report, "Land and Water Resources—A Policy Guide," was prepared by the Department's Land and Water Policy Committee. I established this committee some months ago to analyze the Nation's land and water problems and to recommend policies and programs. Preliminary findings, based upon years of research and program experience of the Department and its cooperators, were presented to a National Conference on Land and People held in Washington last January 15. The discussions at this Conference, and numerous written comments received since, have been extremely helpful to the Department.

At the Land and People Conference, we posed three basic questions—

First, how can we make better use of the land currently in farms which in the foreseeable future will not be needed for crop production? Second, how can we satisfy the rapidly growing demand for land for recreational, urban, and other uses? Third, how can resources be used to generate new economic opportunities for the 1.4 million underemployed persons in rural areas?

Many of the recommendations of the Land and Water Policy Committee are reflected in the President's messages on Agriculture and Conservation and have become part of "Food and Agriculture—A Program for the 1960's," published last March. Others will be reflected in program plans of Department agencies.

I heartily endorse the major findings and recommendations of the Land and Water Policy report. It presents a balanced program of resource development and resource adjustment. Along with changes to bring the land devoted to crop production into balance with requirements, consideration is given to the need for conservation, development, and management programs in order to realize continuing maximum benefits from land and water resources.

The results of a nationwide conservation needs inventory begun in 1958 are being released in another report, entitled "Agricultural Land Resources." A comparison of the findings of the Land and Water Committee with the findings of the inventory indicates that changes in land use under prevailing trends and conditions need to be accelerated to meet the adjustments which now appear necessary. This substantiates the need for the land-use adjustment measures recommended by the Land and Water Policy Committee.

The task of building and establishing a national land and water policy is only begun. Our policy must be one that changes and grows to meet new problems. In the Department of Agriculture, we must constantly face new challenges and develop new ideas, new concepts, and new programs. Pilot projects will be used to test and evaluate new approaches. Essential to this process of change is the direction of research and programs toward basic resource problems, such as the

alternative uses and conservation of our land and water resources, the encouragement of land and water tenure systems to achieve family farms and other social goals, and the means of generating economic growth through development of land and water resources.

We are undertaking these surveys and analyses of land and water problems in the Department in order to clarify our own policies, to promote broader public understanding, and to be better prepared to work with the Congress and others in solving land- and water-use problems. Throughout our studies, we have stressed that we will continue to cooperate closely with other Federal agencies, regional groups, State agencies, and agricultural colleges and universities.

ORVILLE L. FREEMAN,
Secretary of Agriculture.

MAY 1962.

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Part I. Introduction

Background

The establishment of a USDA Land and Water Policy Committee and the preparation of this report were authorized in Secretary's Memorandum No. 1464, August 24, 1961. The initial Committee assignment was to review the present and prospective land, forest, and water resource situation, appraise implications for Department activities, and prepare policy and program recommendations. In formulating and carrying out land and water programs, the Department will cooperate with other Federal agencies, also with State and local agencies. The guiding principles and recommended policy presented are designed to provide a comprehensive and long-range framework for orienting the formulation and operation of Department land and water programs and activities so as to improve the well-being of farm people and of all citizens.

The target year selected was 1980 and projections to that date were based on influences expected to affect levels and trends in such factors as population growth, economic activity, technology, yields, imports and exports, and the requirements of the various uses competing for land and water resources. The projections used should be regarded primarily as reflecting likely directions of change rather than as precise expectations. Material variations in the plausible range of particular projections such as crop yields, population, and exports would significantly affect the calculated resource requirements.

There is obvious need for periodic reappraisals of the resource situation to make adjustments for departures from assumptions, unforeseeable developments, and revised expectations. But many decisions cannot long be deferred and accordingly must be based on the best available information and prevailing outlook. In any case, implementation of the recommendations contained in this report should improve the Nation's ability to cope with resource contingencies likely to arise both during and beyond the selected projection period.

Based on the assumptions used, the study indicates that food and fiber requirements in 1980 could be met with 407 million acres of cropland, or about 50 million acres less than we had in 1959. An acreage about equivalent to that in various temporary land diversion programs in 1961 should be shifted to other uses for at least the duration of the projection period. Although likely to be in surplus for crop production for an extended period, this acreage is a valuable land resource and must be managed to conserve its potential for future generations. In the interim, it is in the social interest that other desirable uses be found for such land.

Agriculture is expected to continue as the predominant consumptive user of water well beyond 1980. The conservation and economic man-

agement of water in agricultural uses is critical for the balanced growth of all water-using industries and the entire economy.

The recommendations of the report are designed to present a balanced program of land and water resource development, improvement, and adjustment. While provision is made for the orderly improvement of cropland through carefully selected irrigation, drainage, flood protection, watershed and other conservation measures, such activities should be in balance with programs for adjusting land use in accordance with needs. Thus, public programs to assist and facilitate land use adjustments have been proposed along with programs for conservation and development.

Some program recommendations are advanced for immediate or pilot action; others will require further consideration and investigation. We urge a series of pilot programs accompanied by careful study and evaluation so that new program concepts may be tested, modified, and developed before full-scale operations are attempted.

A program of research, education, and planning has been outlined to guide land and water resource adjustment, use, and development. Stress is placed on the need for an adequate basis for decisions and informed participation at all levels of interest. These activities will require placing heavy reliance on programs conducted in cooperation with State Agricultural Colleges and Universities.

Major emphasis throughout the report is placed on the encouragement of family-type farm, forest, and recreation enterprises.

This report is a revision of a preliminary report distributed to participants in a National Conference on Land and People called by the Secretary of Agriculture on January 15, 1962. The many helpful comments and suggestions received from members of the conference and others are appreciated.

Although numerous modifications in the preliminary report have been made as a result of such comments and further deliberations of the Committee, the basic appraisal of the situation and the resulting conclusions remain substantially unchanged. Increased cropland requirements from a higher population projection were offset by reduced export estimates, an anticipated increase in livestock feeding efficiency, and lower projected amounts of idle and other land. It is believed that the revisions improve the reliability of the various components of the estimates.

Guiding Principles

The land and water resources of the United States are vital national assets. How we conserve, develop, and manage these natural resources will affect our economic growth, the strength of our Nation, and our long-run status in world affairs.

A large part of these natural resources are privately owned and operated under the laws of the 50 States. The Department of Agriculture has the major responsibility for cooperative programs with the States to conserve, develop, and manage soil, water, grass, forest, and wildlife habitat on private lands. These programs include research, education, extension, technical, credit, and financial assistance. On the National Forests and National Grasslands, the Department administers a multi-purpose program of resource management.

A major objective of a policy for land and water is that these basic resources serve all the people of the Nation. Those who depend on farming, ranching, and forestry should be helped to assess their needs and find solutions to problems they cannot solve for themselves. Policy should assure an abundant and wholesome food supply; adequate sources and supplies of fiber, forest products, and industrial raw materials; and should assist in the conservation of the land, water, and forest resources.

Conservation is the maintenance of the productive capacity of our land and water resources, and their development or improvement to meet future requirements. The Department's goal is to devise land and water programs and supply-management programs that will enhance farm income and achieve long-run and short-run conservation objectives.

Since returns from private or public investment in land and water resource conservation or development occur over long periods of time, projections of future conditions are necessary in reaching current decisions. However, statistical calculations of the Nation's future requirements and potentials can only indicate the probable direction of change. Estimates of the magnitude of future change have limited accuracy.

Present public actions and the individual choices now being made by millions of landowners regarding resource use often preclude future choices. Sometimes it is physically possible to reverse decisions, but it may not be economically feasible.

Institutional arrangements may lead to nonreversible decisions because vested rights or priorities may be created which virtually preclude future choices desirable from an economic or social viewpoint.

Because of the long-run and complex nature of decisions regarding land and water use, it is desirable to state major principles to guide specific policy and program decisions:

- Policy should be comprehensive—for the Nation, for all regions, for all its land and water resources, and for all resource users.

- People directly affected should have ample and continuing opportunity to participate in the formulation of policies and in the operation of programs.

- The combined powers and efforts of the State and Federal governments should be employed in carrying out policies and programs without undue restrictions on freedom of individual decisions.

- Land and water resources should be so combined with other resources that the goods and services produced will provide maximum satisfaction of both present and future needs.

- Public programs should make best use of funds available for investment in land and water conservation and development.

- Costs of land and water conservation should be borne in relation to the sharing of the benefits insofar as is consistent with other public purposes.

- Land and water development programs should contribute to regional and national economic growth.

- Programs should be flexible enough to respond to changing needs and to provide reserves for unforeseen conditions, yet specific enough to achieve immediate objectives.

- Policies should be formulated and programs managed to achieve widespread benefits to farm people and others dependent on land and water resources.

- Policies should recognize the Nation's limited supply of water and of land and should follow sound conservation principles and social value preferences in the use of these vital assets.

Land and Water Problems

A projection of land use based on meeting estimated requirements in 1980 has been made (fig. 1). If the high rate of increase in technological improvements and crop yields continues to increase at a rate equal to the 1950-61 trend, and with appropriate research, planning, and action, the increased demands for agricultural products in the next 20 years can be met with about 50 million fewer crop acres than were available in 1959. Details are presented in Part III.

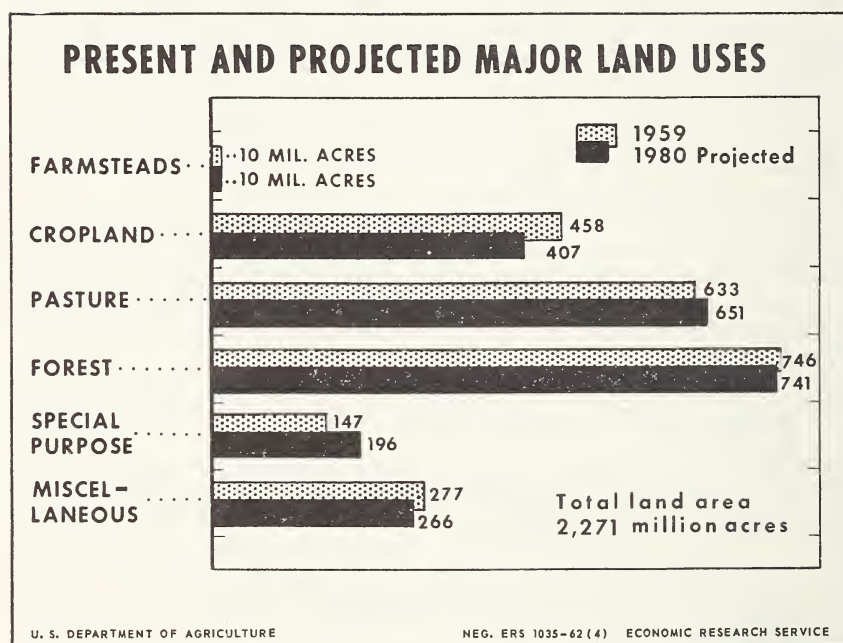


Figure 1

The following major problems need to be taken into account if we are to build better land and water policies and programs:

We can expect our farm production potential to continue to outrun demand for the foreseeable future. Long-range land-use adjustment programs must be devised to maintain efficient production and at the same time make adjustments needed to meet effective demand.

Many acres of unsuitable land are still devoted to crop production. More efficient use of resources and manpower will result from shifting such land to more suitable uses.

Some development and improvement of crop and pasturelands through irrigation, drainage, and flood control is expected to continue for developing family farms, reducing production costs and risks, and for local and regional growth. These improvements have been taken into account in projecting land-use requirements. A balance between such developments and land-use adjustment activities will need to be maintained.

Our rapidly growing population will need greatly increased quantities of land and water for recreation, urban, and industrial activities. At present these needs are met in a haphazard and unplanned way. This is exemplified by the suburban sprawl, the encroachment on potential parklands and open space around our major cities, and increasing costs of water for urban and industrial needs.

New employment opportunities will be needed to offset loss of jobs as land is taken out of agriculture. These new opportunities will be needed to support local communities and family farmers.

Local needs and plans, as well as national programs, should be provided for in coordinated resource development. Principles and procedures for the sharing of responsibility between various Federal, State, and local groups are needed. Private and public roles in all aspects of resource use must be delineated and coordinated.

We need clear understanding of, and agreement upon, the relative advantages of different ways of changing land use, such as acreage allotments, quantity allotments, land rentals, easements, and land purchase.

A majority of small woodland owners are following poor forest practices in managing their lands. The reasons should be more clearly understood so they can be encouraged to produce their share of timber supplies. Incentives to good management must be found.

Land and water problems are of increasing concern to both farm and nonfarm people. Public awareness of these problems and alternative solutions must be generated and the public kept informed of current and projected land and water requirements. Carefully planned programs that will satisfy both rural and urban needs are essential.

Land and Water Policy Highlights

The following outline summarizes the major elements of a recommended policy for directing the Department's land and water activities toward desired goals and objectives. The more comprehensive discussion presented in part IV indicates that Department policy should encourage:

1. *Resource uses that will yield continuing maximum benefits.* Activities should be designed to promote adequate and efficient production; effective continuing use and management of resources; farm output geared to requirements; desirable other uses for lands not needed for agricultural production; and patterns of use and resource development schedules that support economic growth and a balanced and strong economy.

2. *Opportunities for earning adequate farm income.* Farmers should have the opportunity to earn incomes from farming com-

parable to other sectors of the economy; compensation and other assistance should be provided for participation in land use adjustment, supply management, and conservation programs; programs should promote greater income stability; and additional sources of income from new resource uses should be developed.

3. *Conservation of land and water resources.* The use and management of resources should be such as to safeguard productive capacity; protect and improve cropland, grasslands, and forests; conserve moisture, reduce flood and sediment damage, and improve the quality and dependability of water; and preserve selected primitive, wilderness, and wild land and water areas.

4. *Owner operation of family enterprises and an equitable distribution of land and water resource income.* The largest feasible number of efficient family-type enterprises should be encouraged through developing management, production, and marketing arrangements and facilities designed for such enterprises; credit and financial assistance should be provided for ownership and operation; Department programs should be administered to promote family farms and widespread income distribution; and institutional and educational means of strengthening family farm operation and ownership should be explored with State authorities.

5. *Efficient family-type operations.* The Department should direct its research and extension efforts to the continued technological improvement of family-type enterprises, including the development and adaptation of practices for maintaining high soil productivity; using improved plant varieties; protecting against disease, insects, and weeds; effective management of soils in accord with their capability; optimum use of lands for farming, forestry, recreation, and wildlife management; and other practices for increasing the efficiency of family-type operations that reduce costs or increase income.

6. *Intensified rural area planning.* Department activities should provide guidance to State and local planning groups in achieving appropriate development and use of land and water resources in rural areas and desirable patterns of rural residence. Information and consultation should be provided on soils and their suitability; watershed program and land management possibilities; rural zoning and related regulations; technical assistance in accomplishing land use shifts; and means for encouraging proper land use and treatment practices. The potential of comprehensive rural renewal programs should be explored in areas of serious maladjustment.

7. *Expanded participation in rural-urban planning.* Department representatives should cooperate with State and local authorities and make the services of specialists available in the interests of promoting the orderly development and use of land and water resources in areas where urban expansion is occurring.

8. *Increased efficiency of water use.* Practices for improving the efficiency of agricultural water use should be developed and applied and expanded cooperative research undertaken with States on equitable water-use laws and the clarification of water rights. National Forests and Grasslands should be managed to improve water yields and assistance provided to landowners to promote desired water management practices.

9. *Prevention of water and air pollution.* Action in cooperation with other agencies should be taken to identify pollution hazards from

agricultural chemicals and farming practices; and preventive measures developed, including the application of safeguards and improved technologies.

10. *Improved fish and wildlife habitat and expanded recreational enterprises.* Incentives and technical assistance should be provided to private land owners for managing their lands to preserve and increase wildlife, and promote recreational development and other noncrop uses. Technical assistance should be provided to States and local agencies in developing public recreation, forests, game management areas, and hunting grounds.

11. *Utilization of all resources and authorities of the Department.* The Department should fully utilize its available resources and authorities to facilitate desirable resource and human adjustments; and seek additional authority where needed. Credit for housing, water supply, recreation facilities, and electrification and communication services should be provided to encourage desirable patterns of rural living, to stimulate rural commerce and industry, promote rural renewal, and other ways sought to assist in increasing nonfarm employment.

12. *Participation in planning at all levels.* Local citizens should be informed of issues and encouraged to participate effectively in the planning and implementation of programs through strong local organizations. National, regional, and local programs should be integrated, and all should reflect national needs and goals.

Part II. The Present Situation

Our Use of Agricultural Land

A fifth of the land in the United States is used as cropland. Somewhat over one-fourth is grassland pasture and range. One-third is in forest. If grassland and forest land used for grazing are included, about 60 percent of all land in the United States is in crop and livestock production (table 1). If all forest land is included, the area in agricultural use is about 80 percent (fig. 2).

The addition of Alaska and Hawaii has enlarged the land area of the United States by about one-fifth, with the largest increases in forest land and waste.

Cropland acreage reached a peak from 1920 to 1930 with 480 million acres (table 2). There was a decline of 13 million acres in cropland in the late 1930's and a regain of 11 million acres in the 1940's. Since 1950, cropland acreage has dropped by 21 million acres to its lowest point since 1910 (fig. 3).

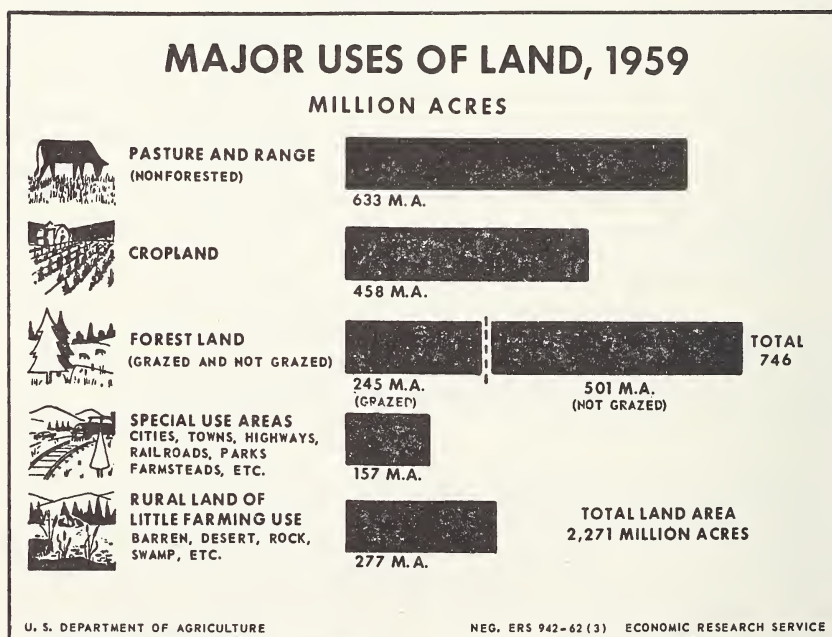


Figure 2

TABLE 1.—*Land utilization: United States, 1959*

| Major use | 48 contiguous States | | All 50 States | |
|--|----------------------------|------------|----------------------------|------------------|
| | Million acres ¹ | Percentage | Million acres ¹ | Percentage |
| Agricultural: | | | | |
| Cropland..... | 457 | 24 | 458 | 20 |
| Crops and related uses ² | (391) | (21) | (392) | (17) |
| Used only for pasture..... | (66) | (3) | (66) | (3) |
| Pasture (excluding cropland pasture)..... | ³ 630 | 33 | 633 | 28 |
| Forest land ⁴ | 614 | 32 | 746 | 33 |
| Commercial..... | (488) | (26) | (530) | (23) |
| Noncommercial..... | (126) | (6) | (216) | (10) |
| Farmsteads, farm roads..... | 10 | 1 | 10 | (⁵) |
| Total agricultural land..... | 1, 711 | 90 | 1, 847 | 81 |
| Nonagricultural: | | | | |
| Special-purpose uses..... | 129 | 7 | 147 | 7 |
| Urban and other built-up areas..... | ⁶ (53) | (3) | ⁶ (54) | (3) |
| Areas limited primarily to recreation or wildlife use..... | (47) | (2) | (62) | (3) |
| Forest land ⁴ | (25) | (1) | (27) | (1) |
| Nonforest..... | (22) | (1) | (35) | (2) |
| Public installations and facilities..... | (29) | (2) | (31) | (1) |
| Miscellaneous land..... | 62 | 3 | 277 | 12 |
| Total nonagricultural land..... | 191 | 10 | 424 | 19 |
| Total land area..... | 1, 902 | 100 | 2, 271 | 100 |

¹ Acreages rounded to nearest million.

² Cropland harvested, crop failures, and cultivated summer fallow, soil improvement crops, and idle cropland.

³ Open permanent pasture and range in the 48 contiguous States comprises 473 million acres and 157 million acres Federal grassland range used for grazing.

⁴ Includes forested grazing land or range, including Federal forest range used by permit. The combined acreage of forest land including areas limited primarily to recreation or wildlife use (the 25 and 27 million acres shown under special purpose uses and embracing reserved forest land in parks, wildlife refuges, wilderness, and related areas) totals 639 and 773 million acres in the 48 and 50 States respectively.

⁵ Less than 1 percent.

⁶ Rounding to the nearest million accounts for part of the difference between totals for the 48 States and 50 States.

Grassland pasture and range were 22 million acres lower in 1959 than in 1930. Much of this change was to forest use and absorption by nonagricultural uses. Interchange between cropland and pasture has occurred in the good land areas. When field crops have been in unusual demand, cropland has increased. When demand has been low, cropland has tended to decrease, with part of the excess going into grassland pasture.

The conservation, crop allotment, and soil bank programs have helped to effect these shifts.

Although acreages in cropland, grassland pasture, and range have moved up or down by only a few percentage points since 1920, there have been marked changes among major uses. Foremost has been the improvement of land for crops and grassland pastures with drainage on too-wet lands, flood control, irrigation, and brush clearing.

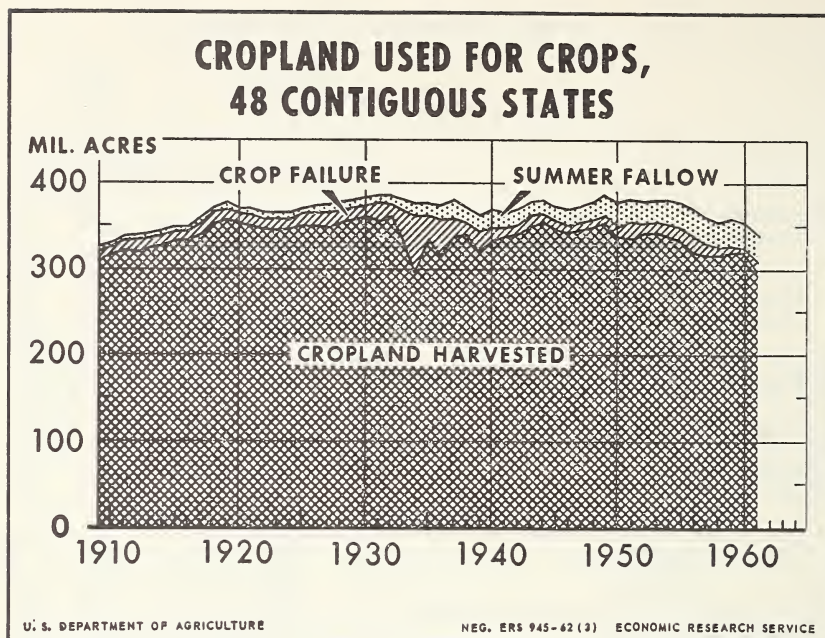


Figure 3

Substantial shifts have been made between uses in some regions. Cropland has been concentrated on fertile and more nearly level areas. Hilly and eroded land has been put in grass and trees. This shift of field crops to the better soil conditions has increased average yields.

In some areas, farm acreage is being absorbed by urban and industrial developments at a rapid rate. Acreages in fringe areas have been abandoned or lie only partly used.

From 1950 to 1960 approximately a million acres a year of agricultural lands were required for urban expansion, highways, airports, and other intensive uses.

Private lands, including Indian lands, comprise 72 percent of the land area of the 48 contiguous States and 61 percent of the land area of the 50 States. Most of the country's crop, pasture, and range production is on private lands (table 3).

Federally owned land makes up 34 percent of the land area in the 50 States. It is in timber and grazing uses and in mineral development. It is also used for recreation, for watershed development, and for wildlife. The Federal lands constitute a reserve in timber, minerals, and water supplies.

Of the 765 million acres of federally owned land in the United States, 483 million acres (or 63 percent) are forest or grazing land. The federally owned land consists of 714 million acres (or 94 percent) of public domain and 51 million acres (or 6 percent) which were acquired by purchase or other means. Nearly half the land in the public domain is in Alaska.

TABLE 2.—*Trends in major land uses, contiguous States, 1910-59*¹

[Million acres]

| Major use | 1910 | 1920 | 1930 | 1940 | 1950 | 1959 |
|---|--------|--------|--------|--------|--------|--------|
| Crops and related uses ² ----- | 347 | 402 | 413 | 399 | 409 | 391 |
| Cropland used only for pasture----- | 84 | 78 | 67 | 68 | 69 | 66 |
| Total cropland----- | 431 | 480 | 480 | 467 | 478 | 457 |
| Pasture and range ³ ----- | 693 | 652 | 652 | 650 | 631 | 630 |
| Forest and woodland ⁴ ----- | 610 | 614 | 615 | 630 | 634 | 639 |
| Other land ⁵ ----- | 169 | 157 | 156 | 158 | 161 | 176 |
| Total land area ⁶ ----- | 1, 903 | 1, 903 | 1, 903 | 1, 905 | 1, 904 | 1, 902 |

¹ Acreages are for the 48 contiguous States. For example, excluded in 1959 are the combined totals for Alaska and Hawaii of about one-half million acres of cropland, and 3 million acres of grassland pasture.

² Cropland harvested, crop failure, fallow, and idle cropland. Cropland and pasture use relates to the preceding years, except for 1959, where they are for the current year.

³ Grassland pasture and other nonforest range land, excluding cropland used only for pasture. Includes idle grassland which probably existed in significant acreages only prior to 1920.

⁴ Includes forest land in parks, wildlife refuges, wilderness areas, national defense sites, etc. Includes commercial and noncommercial forest land, and forest land grazed.

⁵ Includes "special land use areas."

⁶ Remeasurement of the land area of the 48 contiguous United States in connection with the 1960 Census indicated an approximate land area of 1,902 million acres. The total land area of Alaska and Hawaii was 369 million acres. Decreases in the total acres for the 48 contiguous States since 1940 chiefly represent increases in large reservoirs.

Land owned by State and local governments totaled 121 million acres or 5 percent of the land area in 1959. This included State parks, wildlife refuges, recreational areas, school-grant lands under lease or permit for farming and grazing, institutional lands, watersheds, and highway rights-of-way. Since transfer of Federal public-domain grants to Alaska had not been completed, an estimated 100 million acres in scheduled grants are included as Federal land (table 3).

Private and other non-Federal grassland pasture and range totals 474 million acres for the 50 States. An additional 161 million acres of private and other non-Federal woodland and forest are used for grazing. Federal range totals 243 million acres, of which about two-thirds is in grassland or nonforested land. One-third is woodland and forest. Thus, 878 million acres are in pasture and range. Of the total acreage, 633 million acres are grassland or nonforested land, and 245 million acres are in woodland and forest (table 4).

TABLE 3.—*Major classes of land by use and ownership, 1959*

[Million acres]

| Ownership | Cropland | | Grassland pasture and range | | Forest land | | Special use and other land | | Total | |
|---|-----------|-----------|-----------------------------|-----------|-------------|-----------|----------------------------|-----------|-----------|-----------|
| | 48 States | 50 States | 48 States | 50 States | 48 States | 50 States | 48 States | 50 States | 48 States | 50 States |
| Federal..... | 0.8 | 0.8 | 157.1 | 159.1 | 1 198.5 | 1 323.9 | 50.6 | 281.2 | 407.0 | 765.0 |
| State and other public ² | 1.9 | 2.0 | 40.0 | 40.4 | 33.3 | 34.6 | 43.8 | 44.0 | 119.0 | 121.0 |
| Private ³ | 454.3 | 454.8 | 433.0 | 433.5 | 406.7 | 414.3 | 81.8 | 82.7 | 1,375.8 | 1,385.3 |
| Total..... | 457.0 | 457.6 | 630.1 | 633.0 | 638.5 | 772.8 | 176.2 | 407.9 | 1,901.8 | 2,271.3 |

¹ Includes reserved forest in parks and other special uses, and Indian forest.² Excludes State grant land in process of transfer from the Federal public domain to the State of Alaska.³ Includes Indian cropland, pasture and range, special uses, and other land.

TABLE 4.—*Pasture and range, 1959*¹

[Million acres]

| Item | 48 States | 50 States |
|--|--------------|--------------|
| By general ownership and classes of pasture and range: | | |
| Private and other non-Federal land: ² | | |
| Permanent grassland pasture and range ³ ----- | 473 | 474 |
| Woodland and forest pasture ⁴ ----- | 160 | 161 |
| Total private and other non-Federal land----- | 633 | 635 |
| Federal range ⁵ ----- | 240 | 243 |
| Total----- | 873 | 878 |
| By principle vegetative cover types: | | |
| Grassland pasture and range ⁶ ----- | 630 | 633 |
| Woodland and forest pasture and range ⁷ ----- | 243 | 245 |
| Total----- | 873 | 878 |

¹ Preliminary tabulations for the 48 contiguous States from Conservation Needs Inventory and land use inventory projects.

² Private, Indian, State, and local government land, or non-Federal land.

³ From Conservation Needs Inventory 1957-59. (Excludes about 9 million acres of wild hayland harvested for hay, included in cropland harvested acreage.)

⁴ Special estimates of non-Federal woodland and forest land pastured made by Conservation Needs Inventory technical workers.

⁵ Federal range open and usable for grazing; compiled from records and reports of principle Federal land management agencies.

⁶ Includes private and other non-Federal permanent grassland pasture and range; and Federal nonforest range.

⁷ Includes an estimated 160 million acres of farm and other non-Federal woodland and forest pasture and range and approximately 83 million acres of Federal woodland and forest range in the 48 contiguous States.

Land-Capability Classes for Non-Federal, Non-Urban Land

The Land-Capability Classification

The Nation's agricultural land varies widely in capability for agricultural use. The capability classification is a practical grouping of soils. Soils and climate are considered together as they influence use, management, and production on the farm or ranch. Acreage estimates are based on current interpretations. New technologies in agriculture in the future may modify these interpretations.

Eight land classes express the range of suitability for cultivation and other uses and the need for conservation treatment. The classification contains two general divisions: (1) Land suited for cultivation and other uses, and (2) land generally not suited for cultivation. Each of these broad divisions has four classes. The hazards and limitations in use increase as the class number increases. Class I has few hazard or limitations, or none, whereas class VIII has a great many. Brief definitions of the classes are as follows:

LAND-CAPABILITY CLASSES

Land suited for cultivation and other uses including pasture, range, woodland, or wildlife

CLASS I—These soils have few or no conditions that limit their use. They can be safely cultivated without special conservation treatment.

CLASS II—These soils have some natural condition that limits the plants they can produce or that calls for some easily applied conservation practice when they are cultivated.

CLASS III—These soils have more serious or more numerous limitations than those in class II. The limitations may be natural ones, such as steep slope, sandy or shallow soil, or too little or too much water. Or the limitation may be erosion brought on by the way the land has been used. Thus they are more restricted in the crops they can produce or, when cultivated, call for conservation practices more difficult to install or keep working efficiently.

CLASS IV—These soils have very severe limitations that restrict the plants they can grow or the number of years they will produce a cultivated crop. When cultivated, they require very careful management. In humid areas, they are suitable for occasional but not regular cultivation; in subhumid and semiarid areas, crops fail in low-rainfall years.

Land generally not suitable for cultivation but suitable for other uses

CLASS V.—These soils have little or no erosion hazard but have some condition impractical to remove that limits their use largely to pasture, range, woodland, recreation, water supply, or wildlife food and cover.

CLASS VI—These soils have severe limitations that make them generally unsuited for cultivation and restrict their use largely to pasture, range, woodland, recreation, water supply, or wildlife food and cover.

CLASS VII—These soils have very severe limitations that make them unsuited for cultivation and that restrict their use to pasture, range, woodland, recreation, water supply, or wildlife food and cover with careful management.

CLASS VIII—These soils and land forms have limitations that prevent their use for commercial plant production and that restrict their use to recreation, water supply, or wildlife food and cover with careful protection.

Land in Capability Classes

Of the total non-Federal, non-urban land (1,451 million acres) more than two-fifths, or 638 million acres in land capability classes I, II, and III are suitable for regular cultivation. Of this, nearly three-fifths, or 373 million acres, are being cultivated (table 5).

About 238 million acres of the land in classes I, II, and III are in pasture and woodland. Much of this acreage would be available, if needed, for crop production, but much of it requires clearing, draining, or other improvement to fit the land for cultivation. Some of this land is located in small or irregular areas which cannot be farmed efficiently with modern machinery. It would not be economically feasible in the foreseeable future to bring many of these small, irregularly shaped areas into cultivation. Operating farm units usually need a reasonable amount of pasture and woodlots, even on soils suitable for cultivation.

About 36 million acres is high quality class I land with a minimum of problems as far as erosion and continuing use are concerned. About three-fourths of this acreage is being cultivated. The 602 million acres in land classes II and III require moderate to intensive treatment for protection, improvement, and continuing production.

About 169 million acres of class IV land is suitable for limited or occasional cultivation with intensive conservation treatment. Much of it is considered marginal for the common cultivated crops but is suitable for other uses. Nearly one-third of this land is being cultivated.

TABLE 5.—*Land capability classes by land use for 50 States for non-Federal, non-urban land*¹

[Thousand acres]

| Class | Cropland | Pasture and range | Forest and woodland | Other | Total |
|-------------|----------|-------------------|---------------------|---------|-------------|
| I..... | 27, 435 | 3, 940 | 3, 573 | 1, 247 | 36, 195 |
| II..... | 192, 923 | 42, 851 | 43, 426 | 11, 279 | 290, 479 |
| III..... | 152, 970 | 66, 602 | 77, 910 | 13, 854 | 311, 335 |
| I-III..... | 373, 328 | 113, 393 | 124, 909 | 26, 380 | 638, 009 |
| IV..... | 48, 993 | 53, 938 | 58, 413 | 7, 838 | 169, 181 |
| I-IV..... | 422, 321 | 167, 330 | 183, 322 | 34, 218 | 807, 190 |
| V..... | 1, 773 | 10, 525 | 28, 920 | 1, 832 | 43, 051 |
| VI..... | 17, 940 | 166, 288 | 88, 490 | 4, 995 | 277, 712 |
| VII..... | 5, 636 | 138, 690 | 144, 227 | 7, 682 | 296, 233 |
| VIII..... | 66 | 2, 523 | 6, 518 | 18, 136 | 27, 242 |
| V-VIII..... | 25, 415 | 318, 025 | 268, 154 | 32, 645 | 644, 238 |
| Total..... | 447, 736 | 485, 356 | 451, 476 | 66, 863 | 1, 451, 428 |

¹ Preliminary information from the National Inventory of Soil and Water Conservation Needs. The land use figures in this section of the report were obtained by different methods and by using slightly different definitions. Although the figures are not identical with those in other tables, the slight differences do not affect appreciably the comparisons that may be made. Because of rounding to thousands, the total of items listed may not coincide with the total shown.

About 25 million acres being used as cropland are unsuited for cultivation. This land is mainly in land-capability classes V, VI, and VII, with two-thirds of it in class VI.

Erosion is the dominant problem on about three-fifths of the land (424 million acres) in classes II, III, and IV. On many of these acres, in addition to the problem of the control of erosion there are other associated problems such as wetness in sloping soils with clay-pans, and drought in sandy soils.

Timber

Land in Timber Production

Timber production is based on about one-fourth of the Nation's land area. These 530 million acres of commercial forest land amount to about 70 percent of the 773 million forest acres in the United States. In the 48 contiguous States, 639 million acres of forest land amount to about one-third of the land area. Much of Alaska and Hawaii is forested but in these States only southeast Alaska forests have major significance as a timber resource (table 6). Within the 48 contiguous States, about two-thirds of the commercial forest land in public ownership is managed within the National Forest by the USDA. And about three-fourths of the commercial forest land is privately owned; mostly in small farm tracts.

TABLE 6.—*United States forest land area, 1959*

| Ownership | Commercial | | Non-commercial | | Total | |
|-----------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|
| | <i>Million acres</i> | <i>Per-cent-age</i> | <i>Million acres</i> | <i>Per-cent-age</i> | <i>Million acres</i> | <i>Per-cent-age</i> |
| 48 contiguous States: | | | | | | |
| Federal..... | 99. 5 | 20 | 99. 0 | 66 | 198. 5 | 31 |
| Other public..... | 27. 3 | 6 | 6. 0 | 4 | 33. 3 | 5 |
| Private..... | 361. 0 | 74 | 45. 7 | 30 | 406. 7 | 64 |
| Total..... | 487. 8 | 100 | 150. 7 | 100 | 638. 5 | 100 |
| 50 States: | | | | | | |
| Federal..... | 139. 1 | 26 | 184. 8 | 76 | 323. 9 | 42 |
| Other public..... | 27. 6 | 5 | 7. 0 | 3 | 34. 6 | 4 |
| Private..... | 363. 2 | 69 | 51. 1 | 21 | 414. 3 | 54 |
| Total..... | 529. 9 | 100 | 242. 9 | 100 | 772. 8 | 100 |

Softwood sawtimber is the backbone of the timber resource. About 80 percent of the sawtimber inventory volume is in softwood species. Total sawtimber volume is about equally divided between public and private ownership although average volumes per acre are much higher on public forest land. About three-fourths of the Nation's total timber volume is in trees large enough to be manufactured into lumber, and sawlogs constitute by far the largest portion of the timber products harvested each year. As the western old-growth is harvested and eastern stands develop, softwood production will gradually shift to reflect more closely the location of the Nation's commercial forest land.

Characteristics of Timber Production

Timber production is time consuming and complex. A unique aspect of growing timber as a crop is the amount of time required from seedling to harvest. Much of the timber needed 40 to 50 years from now must come from trees established and growing now.

Variations in species composition, size, stocking, quality, growth rates, damage from fire and pests, etc., are significant. Variation in quality, especially in hardwoods, is widespread with values ranging from unmerchantable culls to individual trees worth hundreds of dollars for high-grade veneer timber.

Small Private Forests

More than half of the commercial forest land in the 48 contiguous States is included in about 4.5 million individual ownership units averaging 59 acres in size. Moreover, 86 percent of these ownerships and 46 percent of this area involves forest tracts of less than 100 acres. About three-fourths of all small ownerships are on farms and one-fifth of all farm acreage is forested. Farm forest tracts average only 47 acres in size but in aggregate they account for almost one-third of the entire Nation's total commercial forest land. About 97 percent of small private ownerships are in the East.

Productivity of forest land in farm and other small ownerships is far below potential and substandard stocking following harvest cutting is especially serious. Also, small ownerships are the least adequately

protected from fire, insects, or other losses. Timber quality is uniformly poor. Volumes per acre are far below optimum growth conditions and relatively few small forest properties are under management to produce timber volumes efficiently.

Future Timber Supplies

The dominant consideration in the present timber situation is the necessity to prepare for the future. It is clear that most forests need improved management to realize full growth potential. Inventories must be adjusted to provide the growing "capital" to meet specific future needs. Growth must be stimulated to assure adequate volumes in the various qualities and quantities of raw materials required in the years ahead.

One-fourth of the Nation's commercial forest land is inadequately stocked. Almost half of this area is nonstocked and will require planting to be restored to productivity within a reasonable time. On the remainder, natural regeneration, improved protection, and better management practices should be effective in achieving better stocking.

Annual losses from disease, insects, and fire must be decreased significantly in order to meet future timber needs. Some such losses are direct, as in mortality of affected trees, but much greater losses result from slowing of growth rates and decay or damage to wood otherwise useful for forest products.

Improved harvest and cultural practices are needed on millions of acres to increase the growth and quality of timber products. Removal of cull and defective trees, release from competing vegetation, and pruning and thinning of immature stands are only a few of the measures needed. Industrial, State, and Federal forest lands are relatively well managed and may be expected to contribute their full share of future timber product requirements. However, this is not the case with farm woodlots and other small private ownerships. Yet these areas hold the key to success in meeting future timber demands and it is on these acres that most effort is needed now.

Pasture and Range

Grazing is the largest single use of agricultural land.

The gross income from cattle and sheep in 1960 was over \$12.5 billion. The proportion of annual feed units supplied by range and pasture was: dairy cattle, one-third; beef cattle, three-fifths; and sheep and goats, over five-sixths.

About 10 million head of deer, elk, and antelope also obtain forage on ranges and pastures. In addition, these lands are important as watersheds, for wildlife, and for recreation.

Nearly 245 million acres of forests and woodlands are grazed.

The 878 million acres of pasture and range comprise the largest portion of the Nation's grazing resources. About 63 percent is privately owned and 5 percent is State owned. Eight percent is administered by the Forest Service, 10 percent by the Bureau of Land Management, and 5 percent by the Bureau of Indian Affairs.

Domestic livestock graze 66 million acres of cropland which is used only for pasture.

The Status of Ranges and Pastures

Ranges in good condition can be improved 25 to 50 percent, those in fair condition can be improved 50 to 75 percent, and those in poor condition can be improved 75 percent or more (table 7).

Present range condition and forage production on publicly owned rangelands are, on the average, only half or less of their potential. They fall short of the demands for livestock and game grazing.

TABLE 7.—*Percent of privately owned range in each condition class*

| Region | Excellent | Good | Fair | Poor |
|----------------------------|----------------|----------------|----------------|----------------|
| | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> |
| West..... | 10 | 20 | 30 | 40 |
| Southern Great Plains..... | 5 | 15 | 40 | 40 |
| Northern Great Plains..... | 10 | 20 | 40 | 30 |
| Southeast..... | 10 | 20 | 45 | 25 |

Vast areas, particularly in the western mountains, have been so damaged that flood and sediment hazards have been increased and both the availability and the quality of water produced are affected.

Conservation management is a pressing need if the production potential of tame pastures is to be realized. Fertilization and proper use are the most neglected pasture practices.

Range site and condition surveys have been made on 125 million acres of privately owned rangelands. Surveys are being completed at the rate of 15 million acres a year. The owners of these rangelands, as cooperators with soil conservation districts, have developed basic conservation plans. Such a plan includes: (1) A conservation plan map which contains information on ownership boundaries and range site and condition; and (2) the cooperator's decisions as to what treatments he intends to use in improving and conserving grazing and other resources.

Similar range condition and trend surveys and subsequent management planning have been completed on 45 percent of the rangeland administered by the Bureau of Land Management, Forest Service, and Bureau of Indian Affairs. At present rates, all of these lands will be covered by surveys within 5 years.

Undesirable Woody Vegetation

Grazing on some 240 million acres of rangelands, much of it west of the 100th Meridian, has been severely reduced by the invasion or increase of low-value trees and shrubs, such as mesquite, juniper, sagebrush, and oak. Such increases are generally accompanied by accelerated erosion.

Outdoor Recreation

One of the most significant trends in land and water use is the phenomenal surge of interest in outdoor recreation in the last 15 years. This increasing use far outstrips population trends and most other growth indicators. Recreational visits to the National Forests have increased tenfold since 1945 and reached 102 million in 1961. People are mountain climbing, skiing, skindiving, and water-skiing in ever-increasing numbers. But visitors to developed camp, picnic, or swimming sites, hunters, fishermen, hikers, and sightseers are still the mainstream in the rising tide of outdoor recreationists.

The Nation's forests, waters, and diverse topography combine in endless variety and virtually all outdoor recreation activities are firmly rooted in some combination of these resources. Fortunately, the impact of recreational use upon other major uses is usually minor. Pheasants can be hunted in cornfields, fish can be caught in reservoirs, and hikers may camp in the forest without interruption or conflict with other uses of such areas. Even large areas such as National or State Parks set aside exclusively for recreational use have supplemental watershed and wildlife values.

Ownerships Involved in Outdoor Recreation

Both public and private lands share in providing the land, forest, and water environment for outdoor recreation. Traditionally, hunting, fishing, and hiking have been regarded as pursuits available to all rather than as privileges acquired by wealth, land ownership, or governmental fiat. Farmers, industrial owners, and government agencies have, for the most part, honored tradition with the result that outdoor recreation is generally unrestricted although there is a growing tendency to prohibit public hunting on private tracts. On many millions of acres in Federal ownership outdoor recreation is recognized and provided for as one of the primary uses of the land. Many State and local governments also have established and developed parks and other areas to help meet the demand for outdoor recreation. Most forest industries make their land available for recreation use and even provide free facilities in some cases.

Water Recreation

Much recreation is water oriented. Boating, water-skiing, skin-diving, swimming, and fishing are among the fastest growing outdoor sports. For example, recreational visits to Corps of Engineers reservoirs alone were estimated to total more than 100 million in 1960 or about one-fourth as much as the total of all recreation use of National Forests, National Parks, and State parks that year.

Forest and Open Land Recreation

Forests are prime attractions to outdoor recreationists. They are customarily associated with rugged topography, scenic beauty, diverse vegetation, lakes, streams, and other natural features. As reservoirs of upland game, forests are of particular value for hunting and enjoyment of wildlife. Fishermen, too, find much of their sport originating in the thousands of miles of streams and rivers dissecting the Nation's forested watersheds.

Wilderness recreation is another rapidly growing use of forest and open land. The National Parks and more than 14 million acres in the National Forest Wilderness System provide needed opportunities for recreation in vast, undeveloped areas of land, forests, and waters.

Many nonforested areas such as mountain tops, wastelands, and deserts have unique recreational values; many of the Nation's most striking scenic areas are primarily of this type. Rangelands, too, are important components of outdoor recreation resources. Both large and small game hunting and horseback riding are based to a large degree upon recreational use of open land.

Outdoor Recreation Problems

The most significant aspect of the current outdoor recreation situation is the need to catch up with the demand for recreational facilities.

ties and to move ahead in preparation for still greater demands. As yet, there is no sign of slackening in the overwhelming increase in recreational use of lands, forests, and waters. It is clear that outdoor recreation is one of the many rising demands upon our lands, forests and waters that must be reckoned with now and in the future.

Another related problem is the need to harmonize conflicts between recreational users themselves, and to a lesser degree, between recreation and other uses of land, forest, and water resources. Many of these problems arise from over-crowding, inadequate facilities, and difficulties in regulating outdoor recreation when necessary. For example, water skiing, swimming, and fishing activities frequently overlap to create problems not easily solved.

Wildlife

Animals, birds, and fish are products of land, forest, and water which have both traditional and current value. Perhaps the most significant value of the wildlife resource today lies in its close association with outdoor recreation. Between 1955 and 1960, the number of hunters and fishermen increased 20 percent—a striking index of the growing importance of this aspect of wildlife values. Few values are more difficult to assess on an economic basis than those of wildlife populations.

Sport Fishing

The significance of this sport is indicated by the expenditure of over 50 million dollars for more than 20 million fishing licenses in 1959 and the fact that in 1960 about one-fourth of the men and one-tenth of the women in the Nation participated. Federal and State fish hatcheries currently produce millions of fingerlings and larger fish and many streams are stocked and fished on a “put and take” basis. Mounting threats to fish populations result from stream and river pollution and widespread destruction of fish habitat resulting from urban and highway development and similar activities.

Game Animals and Birds

One in every five men hunted in 1960. Exclusive of waterfowl hunters, about two-thirds of hunters are after small game and one-third hunt big game. Although some artificial stocking of game species is done currently, it is generally agreed that hunting pressure is seldom the limiting factor on game populations. Food, cover, weather, and natural cycles are much more significant.

Game populations—especially big game—may create special management problems when their numbers increase beyond the normal carrying capacity of their habitat. For example, browsing by excessive populations of white-tailed deer in many forest areas prevents establishment and development of young trees needed for future timber crops.

Control of destructive insect populations by birds has major economic significance. Both upland birds and migratory waterfowl are foundations of public hunting and birds are also valued for their esthetic qualities as evidenced by the growing popularity of “bird-watching.”

Destruction of habitat is a major problem facing migratory bird populations today. Measures to acquire and preserve key water

areas in public ownership and to encourage the development of wetland habitats on private land are needed to preserve this resource. Research is needed to develop methods and materials for spraying crops and forests with insecticides to prevent economic loss without damage to the wildlife resource.

Public Lands and Wildlife

Almost all public lands and forests are managed in recognition of wildlife needs and values. For example, on some 500 million acres of public domain and 186 million acres of National Forests, wildlife is recognized as one of the Nation's renewable resources and treated accordingly. In addition, there are about 29 million acres in Federal and State wildlife refuges designed to protect and improve wildlife populations.

For the most part, hunting and fishing regulations on public lands are set by the State concerned. Management of Federal lands and forests is directed toward improvement of food and cover to support larger and more vigorous wildlife populations.

Wildlife on Private Lands

Farms and ranches provide a great variety of cover and food supply suitable for many kinds of wildlife. The private lands of the Nation, because of their extent and variety, hold the major potential for meeting the wildlife conservation and production needs of the future. Private lands provide roughly 85 percent of the wildlife habitat economically feasible of improvement and 80 percent of the game taken by hunting.

Private landowners, especially farmers and ranchers, are the principal custodians of the Nation's wildlife habitat. A wide range of conservation practices on forest, pasture, and cropland—such as windbreaks and farm ponds—benefit wildlife substantially.

Pressure on Wildlife Resources

Growing pressures upon wildlife populations and their habitat require sound management of this valuable national resource. Although problems are numerous, and many will be difficult to solve, it seems likely that concerted efforts can adequately maintain and even strengthen this resource. Extension of existing programs such as farm pond development, fish hatchery production, research, introduction of suitable exotic species, prevention of water pollution, and similar efforts will do much to meet future needs and solve current problems.

All in all, wildlife populations represent one of the many renewable natural resources currently under increasing pressures and clearly destined to receive even greater pressures in the future. Use and management of this resource, like the others, must be improved and strengthened if the needs of future generations are to be adequately met.

Farm Land Tenure

Ninety-three percent of all land in farms, excluding public land under grazing permits, is privately owned. The use of this land is decided largely by individuals who own and operate the land.

From 1940 to 1959, the tenure pattern has been marked by an increase in part owners from 10 to 22 percent, with a decrease in full

tenants from 39 to 20 percent (table 8). The proportion of full-owner operators has been relatively steady; since 1950 it has been unchanged, at 57 percent. Owner-operators, which include full owners and part owners, increased from 61 percent in 1940 to 79 percent in 1959. The proportion of land operated by owner-operators has increased also, from 64 percent in 1940 to 75 percent in 1959. Since 1950, more than half of the owner-operated land has been operated by part owners (fig. 4).

There has been little change in the proportion of all land rented. Renting by part owners has tended to replace renting by full tenants; part owners now outnumber tenants and operate more rented land.

Tenure Adaptations

Significant changes in the tenure structure of agriculture have resulted from the trend toward fewer and larger farms. Farmers increasingly have had to rely on means other than ownership to acquire resources needed for larger operation.

Part ownership.—Renting is a leading source of capital for many farmers. In 1959, 42 percent of all farmers rented part or all of the land they operated. The value of the real estate they rented amounted to \$45.6 billion. This rented real estate was 36 percent of the total value of all farm real estate.

The increase in part owners and corresponding decrease in full tenants in recent years indicates that the traditional concept of leasing as an early and perhaps less desirable tenure status has changed. Over half of all rented land is operated by part owners who, on the average, have achieved a larger scale of operation than either full tenants or full owners. In 1959, preliminary estimates show that the average part-owner farms contained 614 acres, full-owner farms

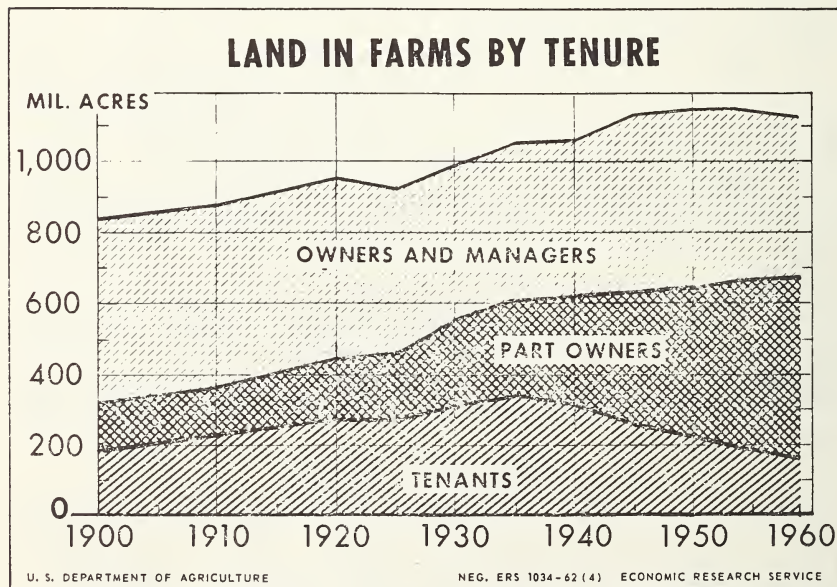


Figure 4

TABLE 8.—*Number of farms and percentage distribution of farms and land in farms, by tenure of operator, selected years, 1940-59*

| Tenure of operator | 1940 | 1950 | 1954 | 1959 ¹ |
|-------------------------|----------------|----------------|----------------|-------------------|
| FARMS | <i>Number</i> | <i>Number</i> | <i>Number</i> | <i>Number</i> |
| All farm operators..... | 6, 096, 799 | 5, 382, 162 | 4, 783, 021 | 3, 707, 973 |
| Full owners..... | 3, 084, 138 | 3, 089, 583 | 2, 744, 708 | 2, 116, 594 |
| Part owners..... | 615, 039 | 824, 923 | 868, 180 | 834, 470 |
| Managers..... | 36, 351 | 23, 527 | 20, 894 | 21, 060 |
| Tenants..... | 2, 361, 271 | 1, 444, 129 | 1, 149, 239 | 735, 849 |
| | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> |
| Full owners..... | 50. 6 | 57. 4 | 57. 4 | 57. 1 |
| Part owners..... | 10. 1 | 15. 3 | 18. 2 | 22. 5 |
| Managers..... | . 6 | . 4 | . 4 | . 6 |
| Tenants..... | 38. 7 | 26. 8 | 24. 0 | 19. 8 |
| LAND IN FARMS | | | | |
| Full owners..... | 36. 0 | 36. 2 | 34. 2 | 30. 8 |
| Part owners..... | 28. 3 | 36. 5 | 40. 7 | 44. 8 |
| Managers..... | 6. 3 | 9. 1 | 8. 6 | 9. 8 |
| Tenants..... | 29. 4 | 18. 3 | 16. 4 | 14. 5 |

¹ Preliminary data for 50 States.

Because of rounding, the percentages shown may not total 100.0.

U.S. Bureau of the Census, Census of Agriculture.

164 acres, and tenant farms 220 acres. Part owners operate almost as much land as full owners and tenants combined.

Vertical integration.—Contract farming, or vertical integration, has increased in importance in recent years, especially for some products, such as broilers, where a high degree of specialization is feasible. These contracts are a useful means for obtaining additional resources, particularly capital and assistance in management and marketing, but their growing use has caused concern as to possible effects on the structure of farm tenure. Much of the concern is related to the possible loss of control over resource use by farmers.

Farm incorporation.—Recent revisions in the Internal Revenue Code have removed many impediments to the incorporation of farms. The law now provides that certain small, closely held corporations may elect to be taxed as partnerships. Earnings of those corporations that meet the necessary requirements are taxed only as income of the individual shareholders and not as income of the corporation.

Other well-known advantages of a corporate organization are limited liability, perpetual life, and improved financing opportunities. But these advantages, as well as the tax-saving opportunity, may be slight for most small- and medium-sized family-operated farms in relation to the problems of incorporating.

There are at present about 10,000 corporations engaged primarily in farming. The full effect of the changes in the Internal Revenue Code upon corporation farming is not known, although farm incorporation in several States increased greatly after passage of the law.

Partnerships.—The Internal Revenue Service estimates that about 131,000 farms are taxed as partnerships. In view of the high capital

requirements for most farms of adequate size, there are compelling reasons for farm operators to acquire additional resources and thereby obtain the efficiencies of larger size. Even so, the unlimited liability feature and other disadvantages of most legal partnerships tend to discourage their wide use.

Other arrangements similar to a partnership in operation but without its legal features are various kinship operating arrangements and some lease arrangements, notably livestock-share leases. The near-partnership feature of many livestock-share leases can be advantageous to both parties, particularly in areas not well suited to cash-crop farming or in areas where livestock production is more profitable than anything else. The landlord's heavy financial participation in non-real estate production items is often the means whereby his active participation in the farm operation is reduced yet his investment and income are maintained. This investment is often vital to the continued operation of the farm livestock enterprise. For a tenant, the high capital investment and the risk involved in herd ownership under the customary 1-year lease may discourage efforts to go into livestock production without the cooperation of the landlord.

Purchase by land contract.—Because of competition for rental land farmers who might otherwise have sought to rent land may buy it. Of several means of financing land purchases, conventional mortgage financing is the most common. However, the use of land contracts to finance land transfers has increased substantially in recent years.

Nationwide, about 30 percent of all landownership transfers are now financed by land contracts, about 3 times as many as in 1946 and 1947. Their use is greatest in seller-financed transfers. At present, 43 percent of all farmland transfers are financed by the seller. More than two-thirds of these transfers are by land contracts.

Farm Size Changes

From 1954 to 1959, the total number of farms declined from 4.8 to 3.7 million, a drop of 23 percent. A little more than a fifth of the decline can be accounted for by a change in the definition of a farm whereby 232,000 units, most of them under 10 acres in size, are not counted as farms. Only farms of 500 acres and over showed an increase. The addition of each farm of 500 acres and over from 1954 to 1959 was accompanied by a disappearance of 77 smaller farms (fig. 5).

There has been a gradual increase in the proportion of farmland in larger farms. The proportion of land contained in farms of over 1,000 acres increased from about a third to a half during the period 1940 to 1959, while farms of 500 to 999 acres increased from 11 to 12 percent. The proportion of farms under 260 acres and amount of land they included decreased sharply. The number of farms of 260 to 499 acres decreased by 2 percent from 1954 to 1959; they show little change since 1940 in the proportion of land operated.

The regional pattern varies. Large farms are concentrated mainly in the Great Plains, West, and Cornbelt. Farm disappearance has been heaviest in the South, corresponding to the decline in sharecroppers and tenants and the shift of land from farming to other uses, such as forestry.

The trend toward fewer and larger farms is seen also in the increase of farms with \$10,000 or more in farm products sales. From 1954

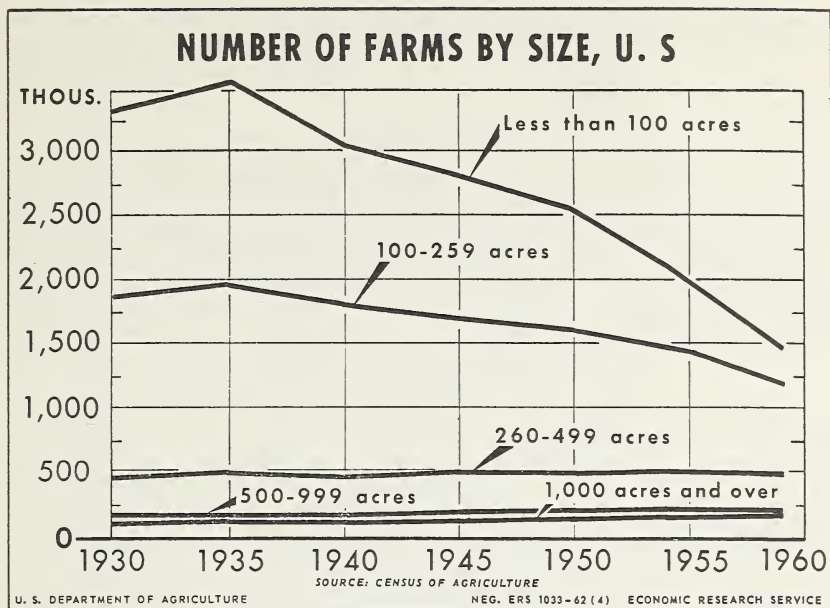


Figure 5

to 1959, the number of these farms increased from 12 to 22 percent of all farms (table 9). In 1959, 13 percent of all farms had sales of \$10,000 to \$20,000 and 9 percent had \$20,000 or more. There was a 72-percent decline in farms with less than \$2,500 in sales. Price levels were roughly comparable in the two periods.

Noncommercial farms, including part-time, residential, and abnormal farms have also declined in numbers, although they increased, proportionately, between 1954 and 1959 from 30 to 35 percent of all farms. The land area of these farms amounted to 127.6 million acres in 1954, 11 percent of the total. The total land area of noncommercial farms in 1959 was 145.8 million acres, over 13 percent of the total land in farms.

Capital investment needed for farming, as measured by the constant dollar value of productive assets per farm, more than doubled between 1940 and 1961. Thus, larger and larger amounts of resources must be amassed by persons wishing to start or stay in farming. Capital requirements needed to achieve any given level of net income, however, vary widely among areas and types of farms. Of the 11 major types of farms, average investment in the period 1950-59 of farms with \$2,500 net farm-family incomes ranged from \$12,000 for peanut-cotton farms in the Southern Central Plains to \$124,000 for winter wheat farms in the Southern Plains. A large proportion of these investment requirements are in land. The land investment in the two cases just cited amounts to 70 and 80 percent, respectively, of total farm investment. Nationwide, nearly 75 percent of total physical farm assets is in real estate.

These trends raise some serious problems about the future tenure structure of American agriculture. In view of the impact of tech-

TABLE 9.—*Number of farms and percentage of all farm products sold, by value of farm products sold, United States, 1950, 1954, and 1959¹*

| Value of farm products sold | 1950 | | | 1954 | | | 1959 | | |
|--------------------------------|-----------|---------|--------------------------------------|-----------|---------|--------------------------------------|-----------|---------|--------------------------------------|
| | Farms | | Percent- age of all farm sales | Farms | | Percent- age of all farm sales | Farms | | Percent- age of all farm sales |
| | Thousands | Percent | | Thousands | Percent | | Thousands | Percent | |
| Commercial farms: | | | | | | | | | |
| \$40,000 or more----- | 103 | 1.9 | 26.0 | 134 | 2.8 | 31.3 | 102 | 2.8 | 31.5 |
| \$25,000 or more----- | | | | | | | 210 | 5.7 | 18.5 |
| \$20,000-\$39,999----- | 381 | 7.1 | 24.8 | 449 | 9.4 | 26.9 | | | |
| \$10,000-\$24,999----- | | | | | | | 483 | 13.0 | 21.9 |
| \$10,000-\$19,999----- | | | | | | | 654 | 17.6 | 15.4 |
| \$5,000-\$9,999----- | 721 | 13.4 | 22.7 | 707 | 14.8 | 20.5 | 618 | 16.6 | 7.4 |
| \$2,500-\$4,999----- | 882 | 16.4 | 14.3 | 812 | 17.0 | 12.1 | 349 | 9.4 | 1.5 |
| Less than \$2,500----- | 1,619 | 30.1 | 9.6 | 1,226 | 25.6 | 7.1 | | | |
| Commercial farms----- | 3,706 | 68.9 | 97.4 | 3,328 | 69.6 | 97.9 | 2,416 | 65.1 | 96.2 |
| \$10,000 or more----- | 484 | 9.0 | 50.8 | 583 | 12.2 | 58.2 | | | |
| Less than \$10,000----- | 3,222 | 59.9 | 46.6 | 2,745 | 57.4 | 39.7 | 795 | 21.5 | 71.9 |
| Other farms ² ----- | 1,672 | 31.1 | 2.6 | 1,455 | 30.4 | 2.1 | 1,621 | 43.6 | 24.3 |
| All farms----- | 5,378 | 100.0 | 100.0 | 4,783 | 100.0 | 100.0 | 1,292 | 34.9 | 3.8 |
| | | | | | | | 3,708 | 100.0 | 100.0 |

¹ All data based on reports for a sample of farms. Data for 1959 are preliminary. Percentages computed from unrounded data.

² Includes part-time, part-retirement, and abnormal farms. Definition of the first two of these classes and of commercial farms with less than \$2,500 farm sales differed in 1959 from previous years.

nology on farm size, and capital and managerial requirements, programs are needed to further the objectives of family operation and access to farming opportunities.

Water Uses

Good water is becoming increasingly scarce in many areas. Unless existing surface and subsurface supplies are managed efficiently and fully developed, the Nation's potential for economic growth will be limited. Converting saline and brackish waters to fresh water may hold promise for relieving undersupply to a degree, but such efforts must be supplemental to programs aimed at conserving and developing surface and ground water resources through watershed management, streamflow regulation, and full economic use.

Available Ground and Surface Supplies

Precipitation may be evaporated or transpired at or near its point of contact, it may recharge underground aquifers, or it may appear almost immediately as streamflow (table 10).

Much of the 70 percent of precipitation that never reaches streams replenishes ground water supplies and sustains vast acreages of forests, grasslands, and nonirrigated crops and pastures.

Nonirrigated crops account for roughly 80 percent of the total value of crops produced in the United States. Livestock and timber production is virtually all on nonirrigated land.

TABLE 10.—*Estimated current water supplies in the United States, excluding Alaska and Hawaii*¹

| Supply item | Millions of acre-feet | Equivalent inches per unit area | Percent of precipitation |
|--|--------------------------|---------------------------------------|-----------------------------|
| Annual precipitation supply ¹ ----- | 4, 394 | 27. 7 | 100 |
| Annual on-site use ² ----- | 3, 068 | 19. 4 | 70 |
| Annual runoff or streamflow supply ³ -- | 1, 326 | 8. 3 | 30 |
| Total ground-water stock ⁴ ----- | 43, 960 | 277. 1 | ----- |
| Ground water as years of runoff----- | 33 years | ----- | ----- |

¹ Unless otherwise indicated, data are from the U.S. Senate Select Committee on National Water Resources, 86th Cong., 2d sess., Committee Print No. 13, *Estimated Water Requirements for Agricultural Purposes and Their Effects on Water Supplies*, Washington, D.C., Govt. Print. Off., 1960, p. 18.

² Includes direct evapotranspiration in forest and nonirrigated agricultural crop production, livestock production, ground water recharge in upstream areas, and other upstream uses.

³ Supply available for downstream withdrawal or nonwithdrawal uses at points below at least a 1,000-square mile drainage area.

⁴ It has been estimated that the total quantity of ground water of the 48 States is roughly equivalent to 10 times the average annual volume of precipitation or 35 times the average annual volume of runoff over the country. The lesser estimate of 10 times the average precipitation is given above as 43,960 million acre-feet. See: A. M. Piper, "The Nationwide Water Situation," *The Physical and Economic Foundation of Natural Resources: IV, Subsurface Facilities of Water Management and Patterns of Supply*, House of Representatives Interior and Insular Affairs Committee, Washington, D.C., Govt. Print. Off., 1953, p. 15.

Withdrawal and Consumption of Existing Supplies

Water withdrawals (excluding hydropower) in the 48 contiguous States from streamflow and ground water are increasing. In 1960, they ranged between 287–303 million acre-feet per year, or between 260–270 billion gallons per day (table 11).

Agriculture now uses from 107–119 million acre-feet per year, or 40 percent of all withdrawals, for livestock, household, and irrigation purposes. The declining importance of agricultural withdrawals relative to other uses is indicated by generally lower rates of increase for agriculture by 5-year periods since 1940.

TABLE 11.—*Trends in major withdrawal and consumptive uses of water between 1940 and 1960 in the United States, excluding Alaska and Hawaii*¹

| Withdrawal and consumptive use items | 1940 | 1945 | 1950 | 1955 | 1960 ² |
|--|-------|------|------|------|-------------------|
| Agricultural withdrawals: ³ | | | | | |
| Withdrawals, million acre-feet..... | 67 | 76 | 90 | 98 | 107–119 |
| Average 5-year percent increase..... | ----- | 13 | 18 | 9 | 9 |
| Percent of all withdrawals..... | 52 | 48 | 47 | 41 | 37–39 |
| All withdrawals: ⁴ | | | | | |
| Withdrawals, million acre-feet..... | 129 | 160 | 192 | 240 | 287–303 |
| Average 5-year percent increase..... | ----- | 24 | 20 | 25 | 20 |
| Agricultural consumption: ³ | | | | | |
| Consumption, million acre-feet..... | 33 | 36 | 44 | 47 | 52–57 |
| Average 5-year percent increase..... | ----- | 9 | 22 | 7 | 4 |
| Percent of agricultural withdrawals.. | 49 | 47 | 49 | 48 | 48–49 |
| Percent of all consumption..... | 92 | 90 | 90 | 89 | 82–84 |
| All consumption: ⁴ | | | | | |
| Consumption, million acre-feet..... | 36 | 40 | 49 | 53 | 60–68 |
| Average 5-year percent increase..... | ----- | 11 | 22 | 8 | 13 |
| Percent of all withdrawals..... | 28 | 25 | 25 | 22 | 21–22 |

¹ Based on analysis of the following sources: (1) U.S. Department of the Interior, Geological Survey Circulars 115, 398, and 456, *Estimated Use of Water in the United States, 1950, 1955, 1960*, by K. A. MacKichan (Cirs. 115 and 398) and K. A. MacKichan and J. C. Kammerer (Cir. 456). (2) Walter L. Picton, *Water Use in the United States, 1900–1980*, U.S. Department of Commerce, Business and Defense Services Administration, March 1960. (3) Various Census of Agriculture reports dating from 1940–1959, U.S. Department of Commerce, Bureau of the Census. (4) Report of the Secretary of the Interior to the U.S. Senate Select Committee on National Water Resources, 86th Cong., 2d sess., Committee Print No. 14, *Future Needs for Reclamation in the United States*, Wash., D.C., Govt. Print. Off., 1960. (5) Hugh H. Wooten, Karl Gertel, and William C. Pendleton, *Major Uses of Land and Water in the United States*, U.S. Department of Agriculture, Economic Research Service, Agricultural Information Bulletin (in process).

² Lower estimates for 1960 based on 33.75 million acres of irrigated land as based on Census of Agriculture 1939–59 trends, and per-acre withdrawal rates of 3.87 acre-feet for irrigation withdrawals from surface water sources and 2.00 acre-feet for withdrawals from ground sources, and an average ground-surface withdrawal rate for 1960 of 3.05 acre-feet per acre irrigated as estimated by the Geological Survey. Upper estimates for 1960 based on 39 million acres of irrigated land as estimated by the Geological Survey. All percentage increases by 5-year periods refer to Census-based estimates of irrigated acreage.

³ Including uses for irrigation, livestock, and other rural domestic purposes.

⁴ Excludes reservoir and pond evaporation.

Annual consumption of water from surface water bodies and wells for all purposes amounts to from 60-68 million acre-feet, or about 22 percent of that withdrawn.

Largely because of a 60-percent consumptive use rate in water applied to irrigated land, diversion and pumping in rural areas account for from 52-57 million acre-feet, or 83 percent of the total consumed for all purposes. This proportion has declined from 92 percent since 1940, due mainly to growing water use in manufacturing and by municipal water systems. Upward trends in the two latter uses are associated directly with population growth and urbanization. Since 1940, these factors have reduced the overall rate of consumptive use from 28 percent of withdrawals to 22 percent of withdrawals.

Agricultural Water Uses by Source of Supply

Water withdrawn for livestock and households in areas not served by public water utilities is largely from ground sources; 73 percent of the quantity needed for irrigation is withdrawn from surface sources; and 70 percent of all agricultural water withdrawals are from surface sources (table 12).

These data reflect western rather than eastern conditions, however, particularly with respect to irrigation. Surface water serves only about 21 percent of the irrigated acreage in the East.

Trends in Irrigation Water Use and Supply Sources

Population growth, urbanization, and industrialization likely will bring about further declines in agricultural water withdrawals and consumption in proportion to municipal-industrial uses. However, agriculture will remain the principal consumptive user of water in the foreseeable future.

Estimates from the 1959 Census of Agriculture indicate that about 33 million acres are now irrigated on 309,000 farms in the 48 contiguous States. Hawaii adds another 141,000 acres and Alaska only 360 acres.

Almost 93 percent of the total irrigated acreage is in the 17 Western States. Eastern irrigation has declined by 297,000 acres from the 2.6 million acres reported in 1954, due to sizable reductions in rice plantings in the Delta States and modest declines associated with improved moisture conditions in 10 other normally humid States. In the Nation, however, irrigation has increased substantially since 1939, with the rate of increase averaging 750,000 acres per year.

Trends over a 20-year period indicate average annual increases of about 2 million acre-feet in water withdrawals for irrigation and of 0.9 million acre-feet in consumptive use (table 13).

Irrigation from ground water relative to surface water has increased considerably since 1939 (fig. 6).

In 1939, only 17 percent of the irrigated acreage in the United States was served with ground water; contrasted with 44 percent at present.

Changes in the West, where initial irrigation was largely through streamflow diversion, are even more striking. Trends imply limited additional opportunities for streamflow storage and diversion in historically important irrigated areas, fairly complete use of available streamflow for agricultural or nonagricultural purposes and, for many new irrigation areas, almost complete dependence on ground water.

TABLE 12.—*Agricultural uses and sources of water in 1960 for the United States, excluding Alaska and Hawaii*¹

| Use and primary source of supply | Annual use | | | | Percent- age of total |
|----------------------------------|-----------------------------|---------------------------------|-----------------------------------|-----------------------------|-----------------------------|
| | Live- stock | Other rural domes- tic | Irriga- tion | Total agricul- tural | |
| Withdrawal: | <i>Million acre-ft.</i> | <i>Million acre-ft.</i> | <i>Million acre-ft.</i> | <i>Million acre-ft.</i> | <i>Percent</i> |
| Surface----- | 0. 78 | 0. 11 | 75. 14 | 76. 03 | 70 |
| Ground----- | 1. 01 | 2. 13 | 27. 79 | 30. 93 | 30 |
| Total----- | 1. 79 | 2. 24 | ² 102. 94 | 106. 96 | 100 |
| Consumption: | | | | | |
| All----- | 1. 68 | 1. 34 | ³ 49. 32 | 52. 34 | 100 |
| Percentage of withdrawal--- | <i>Percent</i> 93 | <i>Percent</i> 60 | <i>Percent</i> ⁴ 48 | <i>Percent</i> 49 | ----- |

¹ Unless otherwise indicated, these estimates are from Kenneth A. MacKichan and J. C. Kammerer. *Estimated Use of Water in the United States, 1960*. U.S. Dept. of the Interior, Geological Survey Circular 456. Washington, D.C., 1961.

² Per-acre requirements as indicated by MacKichan and Kammerer in ¹ above applied to 33.75 million acres irrigated in 1960, with the estimate of acreage irrigated based on trends reported by the Bureau of the Census since 1939.

³ Excludes an unknown portion of reservoir evaporation attributable to storage for irrigation purposes.

⁴ If based on direct farm application rather than total withdrawals, consumptive use in irrigation ranges near 60 percent.

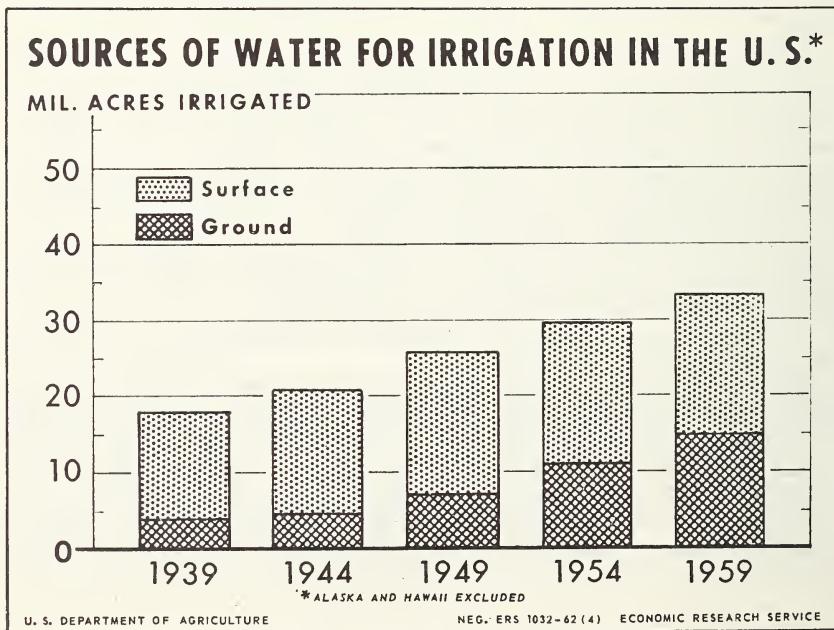


Figure 6

These and other factors have combined in some basins to create serious water allocation and development problems. Solutions depend on cooperative efforts of individuals, agricultural and industrial groups, and concerned levels of Government. Although economic considerations are important, their influence on water allocations is often secondary to institutional factors.

TABLE 13.—*Trends in irrigation and associated water use from 1939-60 in the United States, excluding Alaska and Hawaii*

| Census year | Total irrigated acreage ¹ | Irrigation water use | | | Acreage served by— | |
|-----------------------|--------------------------------------|----------------------------------|---------------------------------|---|----------------------------|---------------------------|
| | | Acre-feet withdrawn ² | Acre-feet consumed ³ | 5-year rates of increase in consumption | Surface water ⁴ | Ground water ⁴ |
| | <i>Millions</i> | <i>Millions</i> | <i>Millions</i> | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> |
| 1939----- | 17. 98 | 63. 65 | 30. 16 | ----- | 83 | 17 |
| 1944----- | 20. 54 | 70. 86 | 32. 92 | 9 | 78 | 22 |
| 1949----- | 25. 79 | 86. 40 | 40. 70 | 23 | 73 | 27 |
| 1954----- | 29. 55 | 93. 67 | 44. 15 | 8 | 63 | 37 |
| 1959----- | 33. 02 | 100. 71 | 48. 40 | 9 | 56 | 44 |
| 1960 (estimated)----- | 33. 75 | 102. 94 | 49. 32 | ----- | 56 | 44 |

¹ Data on total irrigated acreage from the Bureau of the Census (Census of Agriculture).

² Estimated from withdrawal rates of 3.87 acre-feet per acre for water from surface sources and 2.00 acre-feet per acre for ground water irrigation. Trends in average withdrawal rates per acre are associated largely with increasing use of ground water. Average withdrawals per acre of 3.05 acre-feet for 1959 and 1960 taken from Geological Survey Circular 456 as cited in table 11. Averages for prior years (declining from 3.54 acre-feet per acre in 1940) were developed from Geological Survey and other reports cited in table 11.

³ Computed at 60 percent of the irrigation water applied or delivered to farms. Average deliveries for 1960 are estimated at about 2.40 acre-feet per acre irrigated in Geological Survey Circular 456.

⁴ Estimated from various reports of the Bureau of the Census, the Bureau of Reclamation, and the Economic Research Service, as cited in table 11.

Institutional Aspects of Water Use

Federal, State, and local levels of government exercise control over water resources. Authority may stem from constitutional provisions, statutory legislation, or judicial decisions.

Federal authority is limited to powers expressly granted or reasonably implied by the Constitution. Within the sphere of delegated power, the Federal authority is paramount. All remaining powers are reserved to the States or to the people.

Federal Activities and Authorities

Activities of the Federal Government are generally concerned with flood control, navigation, irrigation, hydroelectric power, water supply, watershed protection, fish and wildlife preservation, recreation, pollution abatement, sediment and salinity control, drainage, and

others, including various combinations in multiple-purpose water projects and programs. Regulatory and review functions include licensing non-Federal development of power, deciding controversies and apportioning water between States, and the approving of interstate compacts.

Sources of enabling authority for Federal activities provided by the Constitution include the commerce power, the proprietary power, the treaty-making power, the war power, the general welfare power, the power of equitable apportionment, and the interstate compact approval power.

Commerce and proprietary powers are perhaps the most important Federal authorities. The commerce power provides for Federal jurisdiction over all navigable waters of the United States, including related nonnavigable reaches and tributaries. This power may be used to authorize projects in flood control, navigation, watershed development, hydroelectric power, and multiple-purpose river basin development.

Under the proprietary power, Congress has broad authority to control the use of Federal public lands. It provided the legal foundation for the Reclamation Act of 1902. This source of authority has additional significance for electric power, since energy generated by falling water at a Federal dam becomes exclusive Federal property that may be sold or leased.

Under the treaty-making power, the Federal Government has jurisdiction over international relations concerning the division and development of waters in international streams. Water developments may be modified to serve national defense purposes.

Federal powers to apportion waters in an equitable manner and interstate compact approval powers will probably be used more in the future. As demands on existing water resources increase, there will be more requests by States for reapportionment of water supplies and for new compact arrangements to manage and develop water resources.

State Water Law

Insofar as consistent with Federal authority, each State may adopt its own system of water law. State laws establish conditions for the development, management, and use of water by individuals, firms, and local government bodies. They largely govern the acquisition and transfer of water rights.

For the most part, non-Federal public and private agencies operate under State laws. The structure and application of such laws, accordingly, are important. Perhaps the most significant type of State water legislation is that dealing with the private water rights of individuals.

The doctrines that govern such rights generally are based on land ownership or prior appropriation. The riparian doctrine accords rights to the use of water to certain land on the basis of the land's contiguity to the supply. The owner of a tract of land on a watercourse has certain rights in the flow of the stream.

In several States the owner may divert any water he needs for domestic use, but for irrigation and other purposes the use must be reasonable with respect to the requirements of others.

The same principle applies to the ownership of land that overlies an underground stream. Some States permit limited use of the water on nonriparian land provided that the riparian owners are not adversely affected. The riparian doctrine usually applies to both navigable and nonnavigable watercourses, but may be subject to uses for navigation, fishing, or other public purposes.

Under the appropriation doctrine, the earliest right to water from a particular watercourse has priority over all later rights regardless of the location of the land with respect to the stream. This priority means that in times of water shortage earlier rights have precedence over later rights.

Appropriation rights attach to specified quantities of water and often to specific times, places, and methods of diversion. The right is kept in good standing through use. It may be lost through non-use over a period in most States.

Doctrines applied to percolating ground water include the English rule permitting virtually unlimited use and the American rule of reasonable use, with its modification in the form of the doctrine of correlative rights. Application of the appropriation doctrine to percolating ground water is similar to that for watercourses. Water rights are acquired by those who first withdraw the water and put it to beneficial use.

The riparian doctrine is generally applied to watercourses in 31 Eastern States. Permit requirements are superimposed in some cases upon the basic riparian system.

The riparian doctrine is recognized to varying degrees in the six Western States crossed by the 100th meridian and the three States that border the Pacific. In Hawaii, the riparian doctrine exists along with several other types of rights.

The appropriation doctrine is exclusively followed in eight Western States. It is a part of the law in Alaska and in nine other Western States, and elements of the doctrine exist in some Eastern States.

For percolating water the English rule is still followed in some States, both Eastern and Western. It has been replaced in many by either the American rule of reasonable use or by that of correlative rights.

The riparian and appropriation doctrines are in effect concurrently in many States. In certain States both may apply to watercourses; in others the appropriation doctrine may apply to watercourses but not to percolating waters.

In the United States the riparian doctrine of water rights is composed primarily of judicial law, although there are a few statutes that affirm the existence of or modify such rights. In the West some constitutional or statutory provisions may sever riparian rights or limit their operation.

The appropriation doctrine, in its operation and extent, is covered by constitutional provisions and statutes, supplemented by hundreds of high court decisions. However, it evolved basically from custom, which in the absence of legislation was recognized by the early courts.

The early statutes essentially codified prevailing customs and regulations. The more elaborate statutes were enacted to cover complications.

State law in appropriation doctrine States usually gives domestic and municipal use the highest preference. Irrigation is frequently

second, and commercial and industrial use is third. The influence of these preferences is limited in many States to the initial granting of appropriations, with an exception sometimes made in periods of extreme drought when water may be rationed according to a special system.

Each of the basic doctrines has certain advantages and limitations. In general, riparian principles are not well suited for comprehensive river basin development. The appropriation principle would appear to have somewhat greater possibilities for this purpose. As water requirements expand, there will be increasing need for a system of water rights that will facilitate resource development and management and will be sufficiently flexible to respond to changing needs.

Part III. Resource Requirements and Potentials

Assumptions and Economic Framework

Sound planning must be based on the best possible estimates of trends in population growth, economic activity, technology, yields, imports and exports, and the requirements of all the various uses competing for land and water resources.

Population growth is the most important single factor in determining the demand for the products and services of land and water resources. Requirements are also affected by changes in consumer income, population shifts and other forces modifying the composition of diets as well as by the development of synthetic substitutes for farm products. Changes in technology affect the production, marketing, and utilization of agricultural products and thus will affect both the requirements for and productivity of land and water resources. Increases in crop yields resulting from improved technology significantly influence supply.

Exports and imports also have been considered in appraising future requirements. Increased competitive imports may reduce land and water requirements, while increased exports add to requirements.

Nonagricultural uses of land and water will become increasingly important as population increases. Both increased total requirements and the composition and location of changes in nonagricultural needs will be significant. While the total requirements for these purposes may not seem large, their impact on certain areas and types of land and water resources may be serious.

Public programs must take uncertainties into account and provide for unpredictable contingencies.

The calculated land and water requirements are based on a number of assumptions and economic projections. A population projection representing a level around 45 percent above the United States population in 1960 was selected for 1980. By 1980, disposable personal income per capita is expected to reach a level more than 50 percent above that of 1960; total disposable income is expected to more than double.

Crop yields, water requirements, and other factors affecting estimated output in 1980 are based largely on a projection of levels and trends during the last decade. The projected crop production per harvested acre is 56 percent above 1959. Attaining such a level will require continuing stress on the development and application of improved farm practices.

Population and Income

Population and economic growth in the United States and abroad will directly affect the demand for food and fiber production over the next two decades. In this report the total population for the 50 States

is projected at 261 million for 1980, an increase of about 45 percent over that in 1960. Even greater increases are expected in both total and per capita disposable income (table 14). The income projections are in terms of constant dollars, and increases represent real gains in the output and consumption of goods and services.

TABLE 14.—*Index of population and disposable income in selected years, and projections for 1980*

[1960=100]

| Item | 1950 | 1954 | 1959 | 1960 | 1980 |
|---|------|------|------|------|------|
| Population----- | 84 | 90 | 98 | 100 | 145 |
| Disposable personal income ¹ ----- | 73 | 80 | 97 | 100 | 225 |
| Per capita disposable personal income ¹ ---- | 86 | 89 | 99 | 100 | 155 |

¹ Deflated by Consumer Price Index.

Projected Utilization of Farm Products

Under the assumed economic framework, the domestic use of farm products is expected to rise by about 50 percent in the next two decades. This estimate is based on the 45 percent population increase and a small increase in per capita use of food. In the past decade per capita consumption of food has changed little, even though real per capita incomes have risen by 16 percent. However, with a projected increase of 55 percent in real income per person by 1980, an upgrading of the diet and some increase in per capita use of food can be expected (table 15).

Nonfood uses of farm products decreased almost 25 percent per person in the past decade, largely reflecting the increasing use of synthetic fibers, detergents, and other materials. A further decrease is projected for the next two decades, though at a slower rate.

Exports of farm products in 1960 were about 90 percent above 1950 exports, and reflect, in part, government programs designed to assist exports. Under an expanded Food for Peace Program the goal for exports in 1980 is estimated at 30 to 35 percent over 1960 exports. Total exports estimated for 1980 involve approximately 750 to 800 million bushels of wheat, 7.5 to 8.0 million bales of cotton, 15 to 17 million tons of feed grains, and substantial quantities of oils and tobacco.

Projected domestic use and export requirements for 1980 would require an increase in farm output of 45 to 50 percent above 1959. From 1950 to 1960, farm production increased faster than the population growth of 1.7 percent per year. The excess of production above requirements resulted in a substantial buildup of stocks, particularly of grains.

Projected supply and utilization of livestock products imply an increase in required livestock production of some 50 to 55 percent more than in 1959. A slightly smaller percentage increase in feed use would be necessary for this level of livestock production.

TABLE 15.—*Index of per capita consumption of farm products in selected years, and projections for 1980*¹

[1960=100]

| Item | 1950 | 1954 | 1959 | 1960 | 1980 |
|------------------------|------|------|------|------|------|
| All farm products..... | 105 | 101 | 101 | 100 | 103 |
| Food, total..... | 101 | 101 | 101 | 100 | 105 |
| Livestock..... | 99 | 101 | 101 | 100 | 109 |
| Crops..... | 105 | 100 | 100 | 100 | 98 |
| Nonfood..... | 135 | 105 | 105 | 100 | 85 |

¹ Consumption net of feed and seed.

Farm Output Requirements

Farm output is the volume of farm production available for domestic use and export. Three major categories of gross production have been computed—crop, pasture, and the product added by livestock. Requirements for farm output represent increases in the output of real goods and services. Compared with 1959, projected farm output needed to match projected requirements for 1980 would be up about 45 percent; for crop production up over 40 percent; for pasture, up over 40 percent; and for the net contribution of livestock to total farm output, up about 55 percent (table 16). The estimates reflect an increase of about 8 percent in the efficiency with which livestock convert feed into livestock products.

TABLE 16.—*Farm output in selected years, and projected requirements for 1980*

[1947-49 dollars]

| Item | 1949 | 1954 | 1959 | 1980 | Increase 1959 to 1980 |
|---------------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|-----------------------------|
| | <i>Million dollars</i> | <i>Million dollars</i> | <i>Million dollars</i> | <i>Million dollars</i> | <i>Percent</i> |
| Farm output ¹ | 28, 137 | 30, 177 | 34, 583 | 50, 630 | 46 |
| Total crop production..... | 19, 874 | 19, 997 | 23, 130 | 32, 775 | 42 |
| Pasture production ² | 1, 750 | 2, 035 | 2, 028 | 2, 870 | 41 |
| Product added by livestock..... | 7, 876 | 8, 930 | 9, 984 | 15, 510 | 55 |

¹ Estimates of crop production, pasture production, and product added exceed the value of farm output by the amount of farm-produced power (horses and mules) and the production of hay and pasture seed.

² Based on rough approximations of value of feed-equivalent units.

Crop and Pasture Yields

Crop yields for 1980 are based primarily on projections of trends during the last decade. The projected value of crop production per harvested acre for 1980 is 56 percent above 1959 and 89 percent above 1954. The projected value of pasture production per acre in 1980 is 35 percent above 1959 and 43 percent above 1954 (table 17). Attaining

TABLE 17.—*Crop production per harvested acre, 1954 and 1959, and projected requirements for 1980*

| Item | 1954 | 1959 | 1980 | Increase 1959 to 1980 |
|--|--------|--------|---------|-----------------------------|
| | | | | <i>Percent</i> |
| Crop production per acre harvested: ¹ | | | | |
| Value (1947-49 dollars)----- | 58. 34 | 70. 65 | 110. 26 | 56 |
| Index (1954=100)----- | 100 | 121 | 189 | ----- |
| Pasture production per acre: ² | | | | |
| Value (1947-49 dollars)----- | 1. 87 | 1. 98 | 2. 67 | 35 |
| Index (1954=100)----- | 100 | 106 | 143 | ----- |

¹ Projection based on 1950-61 trend.

² Value per acre of all pasture and range. Projection derived by combining separate utilization estimates of cropland pasture, open permanent pasture, woodland pasture, and grazing land not in farms.

the projected yield levels would require continuing emphasis on production research, together with adequate programs to accelerate the adoption of improved practices by farmers.

Requirements for Cropland

The projected requirements for crop production in 1980 (table 16) and projected yields (table 17) provide the basis for estimating the required acreage of harvested crops. The projected harvested acreage requirement is estimated at 297 million acres, a decline of 28 million acres from the acreage harvested in 1959 (table 18).

TABLE 18.—*Use of total cropland in 1954 and 1959, and projected requirements for 1980*

[Million acres]

| Land use | 1954 | 1959 | 1980 | Change 1959-80 |
|---|-------|-------|-------|-------------------|
| Acres of crops harvested----- | (346) | (325) | (297) | (-28) |
| Acres double cropped----- | (7) | (8) | (6) | (-2) |
| Cropland harvested----- | 339 | 317 | 291 | -26 |
| Crop failure----- | 12 | 11 | 11 | 0 |
| Cultivated summer fallow----- | 29 | 31 | 24 | -7 |
| Total cropland used for crops----- | 380 | 359 | 326 | -33 |
| Soil improvement and idle cropland----- | 19 | 33 | 11 | -22 |
| Cropland used for pasture----- | 66 | 66 | 70 | +4 |
| Total----- | 465 | 458 | 407 | -51 |

The total cropland required for crops includes allowances for the acreage double cropped, crop failure, and the acreage in cultivated summer fallow. The cropland to be used for crop production is estimated at 326 million acres for 1980, a decline of 33 million from that used in 1959.

Total cropland also includes land in soil-improvement crops and idle cropland, as well as cropland used for pasture. Total cropland required in 1980 was estimated at 407 million acres, a decline in total cropland requirements of 51 million acres in the 20-year period. The increase in cropland used for pasture would supply in part the required expansion in pasture production.

The progress made during 1960 and 1961 in achieving shifts in cropland uses and the magnitude of the remaining adjustments needed are indicated in table 19.

The combined operation of the Feed Grain and Conservation Reserve programs brought the acres of cropland harvested and the total cropland used for crops in 1961 near the requirement levels projected for 1980. The acreage of cropland harvested in 1961 was only 6 million acres in excess of projected requirements. The acreage reported for cultivated summer fallow and crop failure in 1961 exceeded projections by another 6 million acres. The total cropland used for crops was thus within about 12 million acres of anticipated requirements.

The amount of cropland not used for crops increased substantially during the last 3 years. The acreage of cropland used only for pasture was unchanged. A substantial increase in acres under Conservation Reserve and Feed Grain programs was partially offset by decreases in idle and other cropland.

TABLE 19.—*Comparison of current acreages used for crops with projected requirements for 1980*

[Million acres]

| Type of cropland | 1960 | 1961 | 1980 | Change | |
|-----------------------------------|-------|-------|-------|---------|---------|
| | | | | 1960-80 | 1961-80 |
| Crops harvested..... | (324) | (304) | (297) | (-27) | (-7) |
| Double cropped..... | (7) | (7) | (6) | (-1) | (-1) |
| Cropland harvested..... | 317 | 297 | 291 | -26 | -6 |
| Crop failure..... | 7 | 12 | 11 | +4 | -1 |
| Cultivated summer fallow..... | 30 | 29 | 24 | -6 | -5 |
| Total cropland used for crops.... | 354 | 338 | 326 | -28 | -12 |

The projected total cropland requirements for 1980 are below 1961 estimates by the equivalent of the acreage in Conservation Reserve and Feed Grain programs in 1961. Permanently shifting this acreage to other uses would accomplish about the magnitude of the net adjustment needed from the 1961 base.

Additional shifts needed over the next two decades to counterbalance the net addition of new cropland would approximate 10 million acres. This is based on the assumption that new cropland development by 1980 would total about 17 million acres; and that about 7 million acres would be absorbed by urban expansion and related uses. On this basis, other noncrop uses would need to be found for 10 million acres of cropland by 1980 in addition to the equivalent of the 53 million

acres that were under Conservation Reserve and Feed Grain programs in 1961.

As has been pointed out, calculations of requirements are based on specific estimates of future population, income, exports, farm technology, and other factors. Departure from these specific projections would, of course, modify the estimates of requirements for cropland. The population projection of 261 million for 1980 corresponds with the Census Bureau Projection (Series II) and is in accordance with recent trends in population growth.

A population 15 million lower than assumed for the calculations in this report would reduce cropland requirements by about 20 million acres. Similarly, lower level of exports (as in 1960) would reduce the acreage of cropland required by over 15 million acres.

An 8-percent increase in livestock feeding efficiency was assumed in the calculation of cropland requirements. Although recent trends show little change in feeding efficiency, Department studies point to the possibility of an eventual "breakthrough" by farmers in the use of feeding technology. A greater improvement in livestock feeding efficiency could further reduce cropland needed. Projected crop yields were based on the trends of the last decade. These projections are 35 percent higher than the projections used in the 1959 studies for the Senate Select Committee on National Water Resources. Any material reduction in the yield projections would significantly increase the acreage of cropland needed.

Use of the assumptions selected indicates that prospective cropland resources will continue to materially exceed requirements for crop and livestock production. Periodic reappraisals of the situation will obviously be needed to adjust for departures from assumptions and reflect revised expectations.

Pasture and Range Requirements

The projected acreage needed for pasture and range was derived from the estimated value of pasture requirements (table 16) and the estimated value of pasture production per acre (table 17), with account taken of the forage value of crop residue. Requirements for pasture and range are shown as increasing more than the estimated increases in yield. A number of possibilities are available for meeting the increased pasture requirements, including intensified pasture improvement practices, increased use of feed concentrates, or shifting varying combinations of additional land to pasture. The estimates (table 20) assume that about one-third of the needed increase would be met by the addition of 4 million acres to the area of cropland used for pasture, and the remainder by shifting and improving land less suited for continuous crop production to pasture. The net increase in land used for pasture would total 22 million acres, 4 million of which would be classified as cropland pasture and 18 million of which would become permanent open pasture.

Since pasture yields are higher on cropland pasture than on permanent or other pasture, the entire increase in pasture requirements could be met by increasing the acreage of cropland pasture by 10 to 11 million acres. If the increased requirements for pasture were to be met by shifting less suitable cropland to permanent pasture, between 60 and 70 million acres would be required.

TABLE 20.—*Land in pasture and range in 1959, and projected requirements for 1980*

[Million acres]

| Land use | 1959 | 1980 | Change 1959-80 |
|--|------|------|-------------------|
| Cropland used only for pasture..... | 66 | 70 | +4 |
| Open permanent pasture and range..... | 633 | 651 | +18 |
| Woodland and forest pasture and range..... | 245 | 245 | ----- |
| Total..... | 944 | 966 | +22 |

No material net change is expected to occur in the area of woodland and forest used for grazing.

Timber Requirements

The projected demand for timber for 1980 is 16 billion cubic feet, or about one-third above the current annual consumption. About seven-eighths of this might come from domestic timber, with the remainder from imports.

Needed growth to meet projected demand is estimated at 68 billion board-feet, or about 44 percent above present production. Projected growth, based on the continuation of recent trends and no significant changes in the area of forest land, would fall short of needed growth by about 14 percent. Deficits of about 28 percent would occur in growth of eastern softwoods and western species.

The deficit in timber production is expected to become increasingly serious after 1980. Prompt and very substantial expansion and intensification of forestry in the United States will be necessary if timber requirements after that date are to be met.

TABLE 21.—*Forest land uses, 1959, and projected requirements for 1980*

[Million acres]

| Land use | 1959 | 1980 | Change 1959-80 |
|---|------|------|-------------------|
| Forest land: | | | |
| Commercial..... | 530 | 537 | +7 |
| Noncommercial..... | 243 | 238 | -5 |
| Areas limited primarily to recreation or wildlife use..... | (27) | (34) | (+7) |
| Total..... | 773 | 775 | +2 |

The area of commercial forest land available for timber production was estimated at 530 million acres in 1959 (table 21). The amount expected to be available by 1980 is 537 million acres. This net gain results from an expected shift of 19 million acres of cropland and 8 million acres of pasture and range to commercial forest, compared

with shifts from commercial forest to other uses of about 20 million acres. However, in view of the timber demand situation and the fact that forest land will continue to be sought for other uses, no surplus of commercial forest land is in prospect. A net of 5 million acres of noncommercial forest land is expected to shift to other strictly nonforest uses. Thus, the overall gain in forest land area is only about 2 million acres. It is expected that the use of 34 million acres of forest land will be limited primarily to recreation or wildlife purposes in 1980, or 7 million acres more than in 1959.

Nonagricultural Land Requirements

Nonagricultural uses of land may be considered in terms of two categories: special-purpose uses and miscellaneous other areas. The special-purpose uses may be divided into three subcategories: urban and built-up areas, areas limited primarily to recreation or wildlife use, and areas used for public installations and facilities. These last-named uses include national defense, water control and supply structures, and public industrial and experimental areas.

The total acreage needed to meet land requirements for special-purpose uses is expected to reach 196 million acres by 1980, an increase of 49 million acres over 1959 (table 22). A decline of 11 million would be expected in the acreage in miscellaneous other areas.

Urban and Built-up Areas

Acreage required by urban expansion and the needs for such other uses as highways and airports are expected to absorb an additional area of 21 million acres by 1980. This would assume a continuation of the rate of absorption in recent years of about 1 million acres a year.

TABLE 22.—*Nonagricultural land uses, 1959, and projected requirements for 1980*

[Million acres]

| Land use | 1959 | 1980 | Change |
|--|------|------|--------|
| Special-purpose uses..... | 147 | 196 | +49 |
| Urban and built-up areas..... | 54 | 75 | +21 |
| Recreation and wildlife areas..... | 62 | 85 | +23 |
| Forest land..... | (27) | (34) | (+7) |
| Nonforest..... | (35) | (51) | (+16) |
| Public installations and facilities..... | 31 | 36 | +5 |
| Miscellaneous other areas..... | 277 | 266 | -11 |
| Total..... | 424 | 462 | +38 |

Recreation and Wildlife Areas

Recreation and wildlife areas include National, State, and local parks; fish and wildlife areas; and related areas designated as primarily for recreational use. The area designated as primarily for recreational or wildlife use is expected to comprise 85 million acres by 1980, including 34 million acres of forest land (table 22).

Public Installations and Facilities

The areas devoted to national defense, water control reservoirs, public industrial lands, sites for experimental work, and other related uses totaled 31 million acres in 1959. The area likely to be in this use is estimated at 36 million acres in 1980.

Miscellaneous Other Areas

This category consists of desert, bare rock, swamp, and similar types of land. Although their economic use is often limited, such areas do provide space to meet a part of the requirements for urban expansion and other nonagricultural uses.

This acreage totaled 277 million acres in 1959. About 62 million acres of this total was in the 48 contiguous States and 215 million acres was in Alaska and Hawaii. The area in this class of land is expected to decrease to 266 million acres by 1980.

Major Land-Use Patterns and Shifts, 1959-80

The largest adjustment in land uses would be required in cropland, where a net reduction of 51 million acres is needed to balance supplies and requirements. The need for grassland pasture and for urban and other special-purpose uses will require considerably more area by 1980 (table 23).

TABLE 23.—*Shifts in major land uses, 1959-80*

[Million acres]

| Land use | 1959 | Reductions | Additions | Net change | 1980 projections |
|---------------------------------|--------|------------|-----------|------------|------------------|
| Cropland..... | 458 | 68 | 17 | -51 | 407 |
| Grassland pasture and range.... | 633 | 30 | 48 | +18 | 651 |
| Forest land ¹ | 746 | 32 | 27 | -5 | 741 |
| Farmsteads and farm roads..... | 10 | ----- | ----- | ----- | 10 |
| Special-purpose uses..... | 147 | ----- | 49 | +49 | 196 |
| Miscellaneous other land..... | 277 | 11 | ----- | -11 | 266 |
| Total..... | 2, 271 | 141 | 141 | ----- | 2, 271 |

¹ Commercial and noncommercial forest land, exclusive of 27 million acres of forest land limited primarily to recreation or wildlife use in 1959 and 34 million acres in 1980. Combined forest land acreage was 773 million acres in 1959 and is projected at 775 million acres in 1980, or a net overall gain of 2 million acres.

It is estimated that the 68-million-acre shift from cropland would be partly offset by a shift of 17 million acres from other uses to cropland. The reduction in cropland would permit the withdrawal of about 25 million acres of land considered unsuited for regular crop production. The remainder would consist of land considered suitable for crop production in case of need for that purpose.

About 6 million acres of the total reduction in cropland would be absorbed by urban expansion and other special uses. Somewhat more than one-half would be shifted to pasture and range use, while about one-fourth would be converted to forest (table 24).

TABLE 24.—*Composition of shifts in major land uses, 1959-80*
[Million acres]

| Land use shift from— | Total reduction | Shift to— | | | | | |
|--------------------------|-----------------|-----------|--------------------------|--|-------------------------------------|-------------------|-------------|
| | | Cropland | Urban and built-up areas | Areas limited primarily to recreation or wildlife use ¹ | Public installations and facilities | Pasture and range | Forest land |
| Cropland..... | 68 | ----- | 6 | 5 | 1 | 37 | 19 |
| Pasture and grazing..... | 30 | 10 | 5 | 6 | 1 | ----- | 8 |
| Forest land..... | 32 | 7 | 5 | 27 | 2 | 11 | ----- |
| Commercial..... | (20) | (7) | (3) | (4) | (1) | (5) | (-) |
| Noncommercial..... | (12) | (-) | (2) | (3) | (1) | (6) | (-) |
| Miscellaneous other..... | 11 | ----- | 5 | 5 | 1 | ----- | ----- |
| Total addition..... | 141 | 17 | 21 | 23 | 5 | 48 | 27 |

¹ Including open space.

² Indicates a priority of forest use and not a reduction in forest land area such as results from a shift to cropland or other nonforest uses.

Shifts to and from forest land are almost in balance, with the expected acreage in noncommercial forests in 1980 being down about 12 million acres, and that in commercial forests being up 7 million acres.

The reduction in miscellaneous other land uses would be taken up by urban expansion and other special-purpose uses.

Increases of almost 40 percent would be expected in urban and recreational use areas. An increase of over 15 percent in areas devoted to public installations is expected. Increases in urban and other special uses would be drawn initially from all major use categories. Since most of these losses would be replaced by further diversions of cropland, the ultimate incidence of absorption by increased nonagricultural uses would be on cropland.

The net shift from agricultural to nonagricultural uses would total 38 million acres.

Projected Water Uses

Water use trends were projected from data given in table 11, using the lower range estimates for 1960. Results are summarized in table 25 and illustrated in fig. 7.

TABLE 25.—*Supplies and uses of water in 1960 and 1980 in the United States, excluding Alaska and Hawaii*

| Item | Supply or use | | | | Increase 1960-80 |
|---|------------------------------|----------------|------------------------------|----------------|---------------------|
| | 1960 | | 1980 | | |
| | <i>Million acre-feet</i> | <i>Percent</i> | <i>Million acre-feet</i> | <i>Percent</i> | <i>Percent</i> |
| Annual renewable supply----- | 1, 326 | ----- | ¹ 1, 326 | ----- | |
| Annual withdrawals: | | | | | |
| All withdrawal uses ² ----- | 287 | 100 | 670 | 100 | 133 |
| Agricultural withdrawals ² --- | 107 | 37 | 129 | 19 | 21 |
| Irrigation withdrawals ² ---- | 103 | 36 | 124 | 19 | 20 |
| Irrigated acres (millions)---- | 33. 75 | ----- | 42. 40 | ----- | 26 |
| Annual consumption: | | | | | |
| All consumptive uses ² ----- | 60 | 100 | 82 | 100 | 37 |
| Agricultural consumption ² --- | 52 | 87 | 62 | 76 | 19 |
| Irrigation consumption ³ ---- | 49 | 82 | 58 | 71 | 18 |

¹ Taken as 1960 annual streamflow supply under the assumption of only nominal water-supply effects of changes in on-site land use, and additional structures.

² Based on extrapolation of water-use trends given in table 11 for uses other than irrigation, with totals adjusted for irrigation use based on extrapolation of acreages irrigated from ground and surface water sources rather than historical water-use data. Average withdrawal rate of 2.93 acre-feet per irrigated acre calculated for 1980, based on a rate of 3.87 acre-feet per acre irrigated from surface water and 2.00 acre-feet per acre irrigated from ground water. Equal acreages of ground and surface water irrigation are projected for 1980, contrasted with a 44-56 percentage distribution in 1960.

³ Computed from consumptive use rates of 1.83 acre-feet per acre irrigated from surface sources and 0.92 acre-feet per acre irrigated from ground sources (60 percent of respective surface and ground water delivery rates of 3.06 and 1.53 acre-feet).

WITHDRAWAL AND CONSUMPTIVE USE OF WATER IN THE UNITED STATES

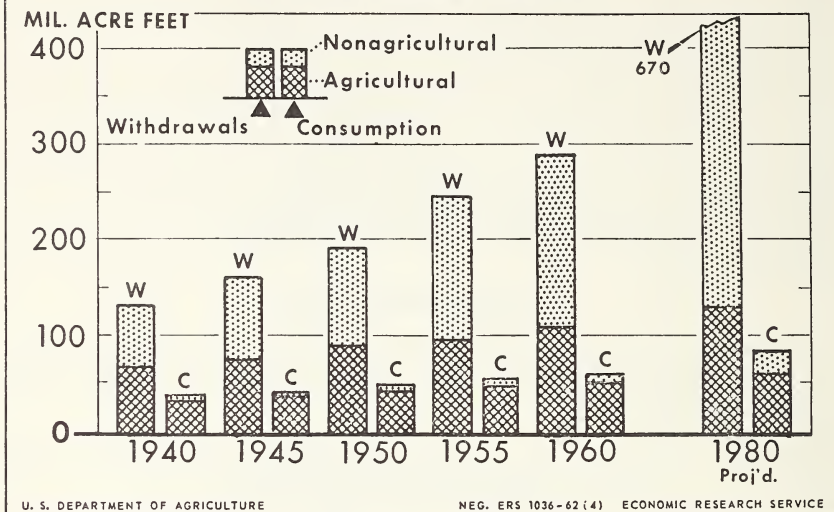


Figure 7

On the basis of trends since 1940, it is estimated that total water withdrawals in the contiguous 48 States in 1980 would amount to 50 percent of renewable surface and ground water supplies, as contrasted to 21 percent in 1960. However, 87 percent of the water withdrawn in 1980 would be available for reuse, compared with 80 percent at present. The consumptive use of water is estimated to increase 37 percent, or to 82 million acre-feet compared with the 60 million acre-feet presently consumed.

Agriculture would continue to be the predominant consumptive user of water in 1980. Irrigation and other agricultural uses of water would be expected to account for 76 percent of the total consumptive use in the 48 States in 1980, compared with 87 percent in 1960. Consumptive use attributable to irrigation alone would fall from the current 82 percent to 71 percent by 1980, despite a projected increase of about 8.7 million acres in irrigated land.

In evaluating the adequacy of the Nation's water supply for meeting anticipated uses in 1980, it should be recognized that present uses already either approach or exceed the limit of available supplies in many of the major western river basins, and that municipal and industrial demands have created supply and treatment problems in many localities in the East. Moreover, a general conclusion applicable to all areas is that the economic management of water in agriculture is closely related to balanced growth of all water-using industries and the entire economy, because of the high rate of consumptive use in agriculture compared to other industries. Modest gains in the efficiency of agricultural water use will result in substantial increases of supplies available for other uses. For example, an average of 21 percent of the water withdrawn for irrigation purposes

in 1960 was lost in transit through seepage and evapotranspiration from canal surfaces or vegetation. If conveyance losses could be reduced by 50 percent, irrigation could expand by over 4 million acres (almost half the increase of 8.7 million acres projected between 1960 and 1980), without any increase in irrigation water withdrawals and on-farm consumption.

Aside from such technologic advances as sea water conversion and possible weather modification, other opportunities exist for increasing renewable water supplies. Snow accumulation, sublimation, and melting rates can be controlled to some extent. More important are possibilities for increasing downstream water yields through the management of vegetation in upstream tributaries. Experimental evidence indicates, for example, that significant absolute increases in water yield from forested watersheds in high-elevation and high-rainfall areas can be obtained through improved vegetation management. Opportunities for such increases appear favorable on about 15 percent of the area of the Western States.

Multiple Uses

As competition for use of land increases, so does the need for more intensive use of land and the need for putting the land to more than one use. The American people cannot afford to use land for a single purpose if that purpose also can be achieved in combination with other uses of the same land. Urban expansion, superhighways, new airports, transmission lines for electrical power, pipe lines for oil and natural gas, and construction of dams and reservoirs require millions of acres of agricultural land. Withdrawals for national defense purposes are likely to continue and demands are developing for the reservation of additional forest lands exclusively for recreational use.

Multiple use is already the guiding principle of management of many public and private lands. Crop production, quality forage for cattle, and suitable habitat for game animals and birds occur on the same farms. Stocking of farm ponds with fish and planting of game foods and shrubs along fence rows also have facilitated a greater number and variety of uses. Timber, water, wildlife habitat, forage, crops, and recreation may be joint products of the same farms, ranches, or forest lands.

Public Law 86-517 specifically directs that the National Forest System be managed for multiple use and sustained yield of all surface resources. The establishment and maintenance of areas of wilderness are consistent with the purposes and provisions of this act.

Much of the Nation's public and private land has long been used for more than one purpose and multiple-purpose development of water resources is generally accepted. Improvement of cropland, pasture, and forest management will benefit watershed runoff and water quality. Much can be done on private lands to improve wildlife habitat and develop recreation as an income producing enterprise to supplement other sources of farm income. Possibilities for further encouraging the multiple use of private lands are particularly significant.

Outdoor Recreation

The next two decades will surely be marked by heavy increases in outdoor recreation. Using very simple techniques, the Forest Service

has estimated that use of the National Forests may increase from the 1961 level of 102 million visits to about 300 million by 1980 and to about 635 million by the year 2000. A similar estimate for the National Park System, developed by the National Park Service, contemplates an increase from a 1960 level of 79.2 million visits to about 400 million by the year 2000. Both of these estimates imply a considerable slackening-off in the rates of increase experienced during the past 15 years. There are no comparable projections for recreation use of State parks which accommodated 255 million visits in 1959, or for all the other publicly owned land and water areas used for outdoor recreation.

Looking ahead to 1980 and considering the increases projected for the National Forests and the National Parks it seems reasonable to expect that outdoor recreation in terms of visits to public recreation areas may increase to 3 or 4 times what it was in 1960.

The total nonurban public acreage designated by administering agencies as being available for public recreation use amounted to about 240 million acres in 1960. Of this, about 60 million acres, including some 14 million acres of wilderness in the National Forests and about 13 million acres in the National Parks, may be considered as primarily for recreational use.

Data are not available on present or prospective outdoor recreational use of private lands or of the acreage of such land that is now or may be, by 1980, used primarily for recreation. However, it is believed that the use of private land for outdoor recreation greatly exceeds the use on public lands.

Fish and Wildlife

There have been two recent nationwide surveys of hunting and sport fishing by the U.S. Fish and Wildlife Service—one in 1955 and another in 1960. Those surveys show that more than one-third of all households in the United States have one or more members who engage in hunting or fishing for sport.

About 25 million persons participated in these sports in 1955. By 1960, that number had increased to about 30 million. This represents an average annual increase of 1 million, or a rate of approximately 4 percent a year. If that rate of increase continues during the next two decades, there will be 50 to 60 million hunters and fishermen by 1980, or twice the number we now have.

The public land and water area dedicated to fish and wildlife use in 1960 amounted to 29.2 million acres. Of this total, 7.8 million acres were in Alaska. Within the 48 contiguous States there were 21.4 million acres administered by fish and wildlife agencies. By level of government, this total was distributed as follows: Federal, 8.8 million acres; State, 12.5 million acres; and county and local, 0.1 million acres.

The impressive extent to which States have been acquiring land for wildlife conservation purposes is a reflection of expanding popular interest. There is every prospect that this activity will continue, and that the land dedicated especially to wildlife will expand substantially during the next 20 years.

Part IV. Policies and Programs

Recommended Land and Water Policy for the Department of Agriculture

A review of the Nation's land and water resource situation and prospects has resulted in the following series of recommendations:

1. *The general objective of the Department of Agriculture is to encourage land and water uses that will yield continuing maximum benefits to the people of the United States.*

This involves the economical production of foods and fibers in quantity and quality sufficient to provide a satisfactory standard of living, to serve as a sound base for economic growth, and to enable the Nation to carry on foreign trade and assistance at effective levels.

The land, water, and forest resources of the Nation are vital to the continuing health, safety, and economic well-being of its citizens. National programs, through planning and coordination, should be directed at the conservation, development, and management of these resources to support a balanced and strong economy.

Present and future programs should be designed and directed to ensure that conservation aims and balanced farm output are achieved at the same time that farm income and opportunity are improved.

Adjustments in land use to balance output and needs should be made in ways that will have the least adverse effect on farming efficiency and will make land and water available to an expanding population for living space, industry, commerce, and recreation.

In the conservation, use, and development of water as a resource, and in the conservation of agricultural lands, the upstream watershed should be regarded as one of the most important bases upon which to plan and build for present and future needs of urban as well as rural residents.

On the National Forests and the National Grasslands the Department should continue to provide for, and ensure the administration of, a multipurpose program of resource conservation, development, and use.

The Department should continue a vigorous comprehensive program of research in land, water, plants, and wildlife conservation and development. Programs to ensure the timely application of research findings should be continued.

The foregoing steps will help the Nation to achieve widespread and equitable distribution of farm, forest, and recreation income through a system of owner-operated family farms, forest holdings, and recreation enterprises; and to keep crop production in balance with domestic and export requirements.

2. *Adequate income for farmers should be an immediate and continuing objective.*

Through its several programs, the Department should seek to enhance the opportunity for the farmer to earn an income from farming that will give him parity with other industries.

The efforts at supply management and price and income support should be consistent with long-run land-use adjustments and with land and water conservation.

Cost-sharing and technical assistance, as well as reasonable compensation for needed shifts in land use, should be available to farmers cooperating in the supply management and conservation programs.

The Department should give special attention to developing new uses and sources of income such as the recreational uses of land, water, forest, and wildlife resources, in ways that will contribute to the economic stability of farm families.

3. The conservation of land and water resources should be carried on as one of the urgent and continuing needs of American agriculture.

The systematic use of proven soil, water, range, forest, and wildlife habitat conservation techniques should be encouraged to avoid costly erosion of soil, to protect and develop land resources for future uses, to manage soil and plant resources for efficient and continuing production of foods and fibers for human needs, and to protect and improve watersheds and water resources for both agricultural and urban uses.

Since demand and production in the future cannot be foreseen with certainty, land, water, and forestry programs should be flexible. Soil resources not now needed for cultivated crops should be kept stable and available.

Department land and water programs should proceed according to the scientifically proven principles of good land use based on soil surveys. These programs should be designed to achieve needed treatment of eroded and depleted soils; protect land against erosion and other deterioration; protect and improve forests, farm woodlands, and grasslands; conserve moisture; reduce flood and sediment damage; improve the quality and dependability of water yields; apply conservation techniques in the management of water; and increase overall farming efficiency. Conservation of agricultural lands should be encouraged through technical assistance, credit, education, and the sharing of costs with the farmer.

The protection and development of entire small watersheds, fitting together the management of crop, range, and forest lands, and the treatment of watercourses to minimize flood damages and sediment yields, to encourage the movement of water into the soil for plant use, and to improve the quality and dependability of water supplies for urban as well as agricultural users, should be a continuing objective. The enterprise, judgment, and leadership available in communities should continue to be utilized in the planning and execution of individual projects.

In the areas of the Nation that have the more serious land-use problems and greater agricultural hazards, special provision for land adjustment, for research, for the conservation treatment of land, for education and demonstration, for credit, and for measures to achieve steady economic growth should be encouraged.

Programs for the conservation, use, and treatment of land and water resources and the making of needed adjustments should take

into account the problems of people who use the land to earn a livelihood.

The Department recognizes the fact that wilderness is a relatively scarce resource. The National Forest Wilderness System has been established to protect millions of acres that have been judged to be predominantly valuable for wilderness. The use of established wilderness and wild areas and the Boundary Waters Canoe Area should not be changed unless there is clear evidence that the gain overbalances the loss of wilderness.

National Forest Primitive Areas are potential parts of the National Forest Wilderness System. They will be carefully studied to evaluate their wilderness character and value before boundaries are finally established. Such evaluation will reflect the overall national need for wilderness areas, the potential supply of such areas, and other resource values and public needs. The Department will endeavor to protect and preserve existing primitive areas and prevent their use for nonwilderness purposes until final evaluation and classification is completed.

4. *Widespread and equitable distribution of income should be induced through encouragement of owner-operated family farms, forest holdings, and recreation enterprises.*

This objective is based on the concept that a system of family farms will make a major contribution to a healthy and vigorous national economy. The farmer, too often the victim of climatic conditions and of price declines beyond his control, is an important factor in the overall economic structure. His economic well-being as a citizen, as a producer, and as a customer and user of a large portion of the national product, merits reasonable provision for safeguard. The historic objectives of a family farm system of agriculture are as valid today as they were during the settlement of this country. We consider a family farm to be one for which the operating family furnishes most of the labor required.

It should be the policy of the Department of Agriculture to assure the largest feasible number of efficient family-type enterprises, first, by developing management, production, and marketing techniques designed for the family enterprise; second, to make available credit and financial assistance as may be needed to keep family farms in healthy condition with returns adequate for the needs of the family; and, third, to provide ownership credit so that qualified farm youth without adequate financial resources may have access to farm ownership. The Department should administer its many programs to promote the family farm and should explore with State authorities the possibilities of strengthening family farms through appropriate institutional and educational devices.

5. *Improve efficiency of farming, ranching, forestry, and recreation by continued adaptation of technology to family-type operations.*

In a world of technological revolution, the most advanced technical processes must be adapted to the family farm unit. This is an objective of basic and applied research in agricultural technology. The Department should direct its production research efforts to the continued improvement and adaptation of technology to family-type enterprises. Technology must be adapted to serve man. Extension,

technical and financial assistance, and credit should be used to stimulate the application of research results on the family farm.

A balance between supply of farm products and needs should be sought through the use of land within its capability and through the diverting of land from production of crops beyond present needs.

Land diverted from use in crops should be given appropriate conservation treatment in the new uses.

Increasing efficiency in the family-type farming operation can be expected to result in lower unit costs of production. Practices to be emphasized should include combination of those which will maintain high soil productivity and high efficiency in soil-plant-water relationships, make use of improved plant varieties, and provide for protection against diseases, insects, and weeds. Farming practices known to reduce the capacity of soils for sustained efficient production should be discouraged.

Opportunities in forestry in family farming enterprises should be encouraged. Development of recreation and wildlife resources as a phase of family farm operation should be stressed where appropriate.

This Department should strengthen its programs to improve management and technologies adapted to family-type operations. The Department should continue to provide educational opportunities, and technical, credit, and financial assistance for this purpose.

The flood plains of small watersheds represent one of the opportunities for protection, improvement, and diversification of farm enterprises. Because of flood threats and erosion, such lands are seldom used to the limit of their potential for crops or other purposes. With the more efficient and varied uses of these acreages as objectives, and with other important advantages accruing to rural communities from watershed projects, the Department program of watershed protection and flood prevention should be pressed. Such an effort should be used to adjust and stabilize the economies of family farms and of communities. A broadened watershed program including forestry, recreation, and wildlife management will accomplish much toward obtaining needed balance and efficiency in use of these flood plain areas.

As with flood plains, the development of wetlands should be considered under a broad program including farming, forestry, recreation, and wildlife management. Technical, financial, and credit assistance should be made available to family-type enterprises when wetland improvements will result in a more adequate farm base and family income. In this program, all values of the land for current and future uses should be carefully weighed.

6. The Department should offer guidance to the type of land use and the pattern of rural residence to ensure community improvement, expansion, and development.

Major land-use changes accompanying the Nation's shift from a rural to an urban economy are creating new, and compounding existing, social and land-use problems. The press for new living space often may result in efforts to put some lands into uses for which they are poorly suited. Shifts from crops to grass and trees, or to urban, industrial, transportation, and other nonfarm uses, create many community problems.

The Department has major interest in, and responsibility for, offering guidance and help in obtaining sound use of land and water resources and patterns of rural residence that will facilitate provision

of community, educational, health, and other services. The Department, therefore, should increase its efforts to furnish technical information on soils, water, and land uses to State or local organizations responsible for community planning and development.

This service should include: (a) The provision of accurate information on soils showing their suitability for specific purposes, including high-value agricultural use; (b) assistance to State and local planning groups in interpreting information on soils; (c) assistance to local governments and other organizations to understand opportunities and limitations in the watershed protection and flood prevention program; (d) information to Federal and State agencies on land and water use planning, land management, rural zoning, and other means to prevent occupancy of lands creating problems involving health, safety, or high-cost services; (e) technical assistance to owners of rural land to make needed adjustments and achieve proper use and treatment; and (f) cooperation with other Federal departments to encourage proper use or development of all rural lands.

In some areas of the country inappropriate use of land and water resources, inadequacy of the size of farm units, and abandonment of rural areas through outmigration will justify a rural renewal approach. In such instances purchase of the land and resale of the areas suitable for farming in adequate family type farm units may be the most feasible solution. Land not suited to farming could under the rural renewal program be used for forestry or for recreation.

7. The Department should cooperate with State and local agencies in furnishing technical services and information to guide land and water use where urban expansion is occurring.

Department representatives should cooperate with State and local authorities and make available the services of specialists in dealing with individual and community problems growing out of the changing uses of land and water resources.

Information gathered through soil surveys on the suitability of certain soils for various uses related to urban development should be made available to persons concerned with urban expansion programs as well as those involved with agricultural uses of land resources.

Assistance in planning open space and recreational areas within easy access of urban centers should reflect consideration of the values of land and water resources in various uses.

In conversion of agricultural land to urban and related uses, the Department should discourage practices which invite erosion and high maintenance costs. Developers, builders, and planning agencies should be encouraged to make use of information available through soil surveys.

Planning and development on a watershed basis should be encouraged as a means through which optimum benefits from soil, water, forest, grass, and wildlife conservation may be achieved for both rural and urban residents.

8. Increase efficiency of water use and promote water conservation by improving soil and water management, and by adjusting institutional arrangements to promote efficiency and avoid waste.

As one of the largest users of water, agriculture has a responsibility for its conservation and efficient use. Many studies show that the efficiency of agricultural water use could be greatly improved, yet

trends of the last decade indicate that limited improvement has been achieved.

The Department should encourage the application of present knowledge and undertake cooperative research on problems of agricultural uses of water and institutions affecting water use. States should be encouraged to adopt equitable water-use laws that clarify rights to use water resources and promote optimum use. Development of water resources should recognize present rights of water users. As uses of land are changed to fit altered conditions and meet new needs, water requirements can be expected to change. Changing situations may necessitate adjustments in State water laws and their administration.

The National Forests and National Grasslands should be managed to increase the quantity and improve the quality of water received from such lands.

Technical and cost-share assistance and credit should be supplied to help landowners promote conservation in water use on farmlands, and promote water yields of higher quantity and quality. This is especially significant where these lands are in agriculturally important watersheds from which supplies for urban and other users are drawn.

9. The Department should increase efforts to reduce the harmful effects of water and air pollution, soil contamination, and pesticides and herbicides through research and application of improved technologies.

Dissolved salts, suspended sediment, and turbidity are among the principal impairments to water quality. Accumulation of salts and toxic materials in soils is one of the hazards of irrigated agriculture. Chemical solutes from unusually heavy fertilizer application on agricultural land may reduce water quality. The leaching of accumulated salts in irrigated soils with water of low salt content may increase dissolved solids in return flow and thus aggravate water problems for other users.

Silt or sediment from eroding agricultural lands, deposited in reservoirs, stream channels, on flood plains, or in municipal areas, represents tremendous economic losses.

The increasing pollution of air with gases, fumes, and solids has definite agricultural implications. Evidence is mounting that certain of these pollutants damage livestock and crops, including forest vegetation.

The greatly increased use of agricultural chemicals has been attended by certain problems. Unless properly used, pesticides can create hazards by contaminating foods, by endangering livestock, game animals, fish, birds, pollinating insects, and beneficial parasites and predators, and by affecting the soil and plants grown in the soil.

In the search for solutions to all of these problems, agriculture shares responsibility. Steps should be taken rapidly to identify hazards, establish safeguards, and develop improved technologies. The Department should cooperate with other departments, public agencies, and State and local groups to find needed solutions to these problems.

10. The Department should provide landowners with technical and financial assistance to develop, maintain, and improve the habitat for fish and wildlife on their lands and to develop recreational enterprises.

The Nation's privately held lands, because of extent and variety,

hold a major potential for meeting the wildlife conservation and production needs of the Nation. These private landowners are the principal custodians of the Nation's wildlife habitat. Incentives should be provided for them to manage their lands to preserve and increase wildlife populations for recreational and other uses.

Cost-sharing and credit as needed should be made available for such practices as construction of fish ponds, for the planting of vegetation for game food and shelter, and for protection of this environment.

The Department should offer technical assistance to States or local agencies in the development of rural lands to supplement present acreages of public parks, State forests, game management areas, and public hunting grounds.

11. In formulating land and water programs, the Department should utilize all of its resources and authorities to assure optimum opportunities for people in rural areas.

As adjustments in land and water use occur, the Department should continue to utilize its resources and authorities to facilitate human adjustments. Land- and water-use adjustments should maximize the opportunities for full employment by families remaining on rural land. This will require technical and financial assistance to families to help them adjust the size or nature of their operations. Greater emphasis should be given to enhanced income opportunities in forestry and in recreational enterprises. Ways to increase nonfarm employment in rural areas should be sought and assistance given in their development.

Credit for adequate housing, domestic water supply, recreation facilities, and electrification and communications services should be provided to encourage desirable patterns of rural living and to stimulate rural commerce and industry.

12. Greater emphasis should be placed on participation in planning at local, State, and National levels to provide for the conservation and wise use of land and water resources.

Satisfying the growing need for multiple use of land and water resources requires cooperation by all interests. All persons concerned must be made aware of the importance of maintaining proper balance between present and future needs.

Plans and programs should focus attention of local citizens upon the full range of solutions and adjustments. Single programs should be related to overall opportunities and requirements. Local citizens should be encouraged to participate fully in the planning and implementation of action programs. Strong local organizations should be promoted and kept informed of changing national conditions and of opportunities to adjust to future needs through timely community action. National programs should be integrated with local community plans, and local plans should reflect national needs and goals.

A Land and Water Program

In view of land-use adjustments likely to be needed over the next 20 years, desirable rates of adjustments and proposed measures to contribute to adjustments have been outlined. A long-term program of conservation and development, including measures to make farming and other employment opportunities available in rural areas is also recommended. The necessary basic surveys, research, planning,

legislation, and organizational arrangements would be worked out with cooperating Federal, State, and local organizations.

Projected Land-Use Adjustments

Cropland in the 50 States totaled 458 million acres in 1959. Requirements of cropland for 1980 are calculated at about 407 million acres. This reduced amount of cropland is calculated to be adequate to meet export needs and provide an upgraded diet for 261 million people by 1980. This is an increase of approximately 46 percent in farm output requirements for food and fiber for 1980 as compared with 1959. Crop yields during the past 12 years have increased at an average annual rate of 2.5 percent. This trend in crop yields was projected to obtain the estimate of crop production per acre in 1980.

There is a potential of 638 million acres of cropland (classes I, II, and III) in the United States and another 169 million acres that might be used for limited or occasional cultivation at high cost and with intensive conservation treatment (class IV). Thus, sufficient productive land is available to meet the needs for food, for fiber, and for the non-agricultural requirements of an expanding population, with continued advances in technology and continued efficient use of land and water.

Calculated needs for food and fiber in the next 20 years can be met with a net reduction in cropland of 51 million acres. Utilization of this 51 million acres will allow us to partially meet the expanding needs for pasture, forests, recreation, wildlife, urban, and industrial uses.

Since a projection of future needs cannot have a high degree of accuracy, provision for adequate cropland reserves is an essential part of the Nation's land policy. As a Nation, we are fortunate to have such a large cropland potential. It is a valuable national asset which should be conserved for the future.

The 20-year projection of land-use changes (table 26) shows the adjustments needed to meet estimated requirements. Many of these projected land-use shifts are related directly to population growth. Shifting to urban and industrial uses and to public facilities is mainly a problem of planning and guidance. Other shifts out of farm use to recreation and wildlife purposes will require technical and financial assistance from public programs, in addition to planning and guidance. The shifts between crop, pasture, forest, and nonfarm uses involve adjustments within farms and between farms, and also will require public programs.

In relation to farm production adjustment efforts it would be desirable to shift a large acreage of cropland to pasture, forest, and recreation and other uses in the first few years.

In addition to these adjustments, there is the problem of keeping potential cropland from being brought into use before it is needed. Some conversion of pasture and forest land to cropland will probably take place as individuals seek to increase their income. Encouragement should be given, however, to defer such conversions to the latter part of the 20-year period, when cropland will be more nearly in balance with requirements. The goal proposed here for the first 5-year period is to retire 35 acres of cropland for each new acre of cropland added. In the second 5-year period the goal is to retire 17 acres of cropland for each new acre of cropland added. If these goals were achieved in the early years, in the third and fourth 5-year periods as much cropland could be added as is retired.

TABLE 26.—*Projected land-use adjustments*

[Million acres]

| Change | 20-year pro- jection | First 5 years | Second 5 years | Third 5 years | Fourth 5 years |
|---|----------------------------|------------------|-------------------|------------------|-------------------|
| Cropland: | | | | | |
| To urban..... | 6.0 | 1.4 | 1.4 | 1.6 | 1.6 |
| To public facilities..... | 1.0 | .3 | .3 | .2 | .2 |
| To recreation, open space, wildlife..... | 5.0 | 2.0 | 2.0 | .5 | .5 |
| To pasture..... | 37.0 | 25.0 | 7.0 | 3.0 | 2.0 |
| To forest..... | 19.0 | 6.5 | 6.5 | 3.0 | 3.0 |
| Total..... | 68.0 | 35.2 | 17.2 | 8.3 | 7.3 |
| Pastureland: | | | | | |
| To cropland..... | 10.0 | .5 | .5 | 3.0 | 6.0 |
| To urban..... | 5.0 | 1.2 | 1.2 | 1.3 | 1.3 |
| To public facilities..... | 1.0 | .3 | .3 | .2 | .2 |
| To recreation, open space, wildlife..... | 6.0 | 1.5 | 1.5 | 1.5 | 1.5 |
| To forest..... | 8.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Total..... | 30.0 | 5.5 | 5.5 | 8.0 | 11.0 |
| Forest land: | | | | | |
| To cropland..... | 7.0 | .5 | .5 | 2.0 | 4.0 |
| To urban..... | 5.0 | 1.2 | 1.2 | 1.3 | 1.3 |
| To public facilities..... | 2.0 | .5 | .5 | .5 | .5 |
| To recreation, open space, wildlife..... | 7.0 | 2.0 | 2.0 | 2.0 | 1.0 |
| To pasture..... | 11.0 | 2.5 | 2.5 | 3.0 | 3.0 |
| Total..... | 32.0 | 6.7 | 6.7 | 8.8 | 9.8 |
| Miscellaneous: | | | | | |
| To urban..... | 5.0 | 1.2 | 1.2 | 1.3 | 1.3 |
| To public facilities..... | 1.0 | .2 | .2 | .3 | .3 |
| To recreation, open space, wildlife..... | 5.0 | 1.3 | 1.3 | 1.2 | 1.2 |
| Total..... | 11.0 | 2.7 | 2.7 | 2.8 | 2.8 |

Existing programs should be reviewed and changed as necessary to keep land use more nearly in balance with requirements. Exceptions would be made for assistance in enlarging inadequate family-type farms.

In 1961, 25 million acres were in the Feed Grain Program and 28.4 million acres were in the Conservation Reserve. Conservation Reserve contracts will expire on 16.8 million acres in the next 5 years and on 11.6 million acres in the second 5 years. As contracts expire these lands will be eligible to participate in any Department of Agriculture land diversion program. There are about 600,000 cropland acres under contract that have been shifted to grass in the Great Plains Conservation Program. Contracts in the Great Plains Conservation Program will expire on 300,000 acres in the next 5 years and on 300,000 acres in the second 5 years. These lands also will be eligible to participate in land diversion programs.

Land diversion programs for crop production control may be recommended for some major crops in the next few years. Land now in the Conservation Reserve or Great Plains Programs not suitable for cropping should not revert to crop production. In exchange for giving up the right to produce crops, the owners should be compensated and assisted in shifting their land to other uses. Payments for long-term easements or total rentals for the period of a contract should not exceed the agricultural value of the land. Eventually, the annual cropland diversion programs should be phased into the permanent land-use adjustment program.

Programs are proposed in the following sections to convert cropland to grass or trees and to assist in developing recreation and wildlife uses. These would be voluntary programs. If a farmer having eligible land wanted to cooperate he could apply for participation in the programs best suited to his circumstances.

Long-Run Adjustment of Cropland to Grass.—Under this proposed program, cropland, including part of the lands now under the Conservation Reserve and Great Plains Programs, would be converted to or kept in grass. The purpose would be to return poor cropland to permanent grass cover and to place some of the better land in a grassland reserve. In its early phases, the program would give primary attention to lands that will be coming out of the Conservation Reserve, although it would be offered on all eligible lands.

The procedure might be as follows:

1. Examine expiring Conservation Reserve contracts or applications from other farmers wishing to participate in a cropland conversion program and classify the land into two categories based on soils and other factors.

Category A. Land poorly adapted to cropping.

Category B. Land suitable for continued cropping but which should be kept in a grassland reserve until needed.

Consideration should be given to local land-use plans in administering this program. Applications would be reviewed by county committees to select the farms and land in the county to be accepted under either category. Agreements or easements would not be considered where county committees indicate the land soon will be out of crop production anyway because of urban or other developments.

2. For category A (permanent grassland) offer the owner of the land a lump sum payment for a long-term easement to discontinue cropping but to allow the land to be used for permanent grass or noncrop uses. Also offer cost-sharing arrangements for initially improving or establishing grass cover or other facilities required for grazing use.

An easement on land not suited for cultivated crops would provide long-term protection against use of this land for cultivation.

3. For some of the lands in category A that are intermingled with publicly owned grazing lands, public land purchase and management should be considered. Loans to approved local organizations might be made for land purchase to establish grazing districts.
4. For category B (grassland reserve—land suited for crop use) an offer should be made to cost-share the work needed initially to improve or establish grass cover and livestock water. The

permitted or prohibited uses would be specified. The owner would refrain from returning the land to cultivation in return for a stated annual rental per acre. This would have to be administered on a year-to-year basis with options for the Government to renew for a stated term until the enactment of legislation authorizing longer term agreements. The rental offered should be based on the fair difference between the expected return from the permitted use of the land and what it probably would *net* if planted to the cultivated crop to which such land in the area most likely otherwise would be devoted.

The estimated acreages of cropland that might be converted to grass follow:

[Million acres]

| Type of arrangement | 20-year pro- jection | First 5 years | Second 5 years | Third 5 years | Fourth 5 years |
|---------------------|----------------------------|------------------|-------------------|------------------|-------------------|
| Easements..... | 12 | 6 | 2 | 2 | 2 |
| Rentals..... | 25 | 19 | 5 | 1 | 0 |
| Total..... | 37 | 25 | 7 | 3 | 2 |

Conversion of Cropland to Trees.—A program is needed to convert cropland to trees. Much could be accomplished by a voluntary program under which farmers would agree to establish and maintain tree cover on cropland placed under contract for a stated number of years.

Cropland considered for conversion to trees would be placed in categories similar to those proposed above under the program for converting cropland to grass. For cropland unsuited for crop use that should be permanently in trees, owners would be offered a lump sum payment for a long-term easement which would insure noncrop use.

Cropland suited for crop use could be considered for conversion to trees under the same terms as those unsuited, or under an alternate rental agreement. Lands already planted to trees would not be eligible under either arrangement. However, as an inducement to holders of such land to maintain it in trees, long term, low interest, deferred payment loans or cost-sharing for timber stand improvement would be offered as needed.

Features of a possible rental agreement include an annual rental for 15 years if owners do not return land to cultivation during the period; and bids or other procedures to determine acceptable annual rentals.

Under either arrangement, the Government would share the cost of planting. Owners could harvest forest products during the contract period if harvesting was done according to good forest practices.

Public purchase and management would be considered where croplands suitable for timber production are mingled with other public forest lands or where croplands suitable for timber production could be acquired in blocks large enough to be administered as public forests.

The estimated acreages of cropland that might be converted to trees follow:

[Million acres]

| Type of arrangement | 20-year projec- tion | First 5 years | Second 5 years | Third 5 years | Fourth 5 years |
|---------------------|----------------------------|------------------|-------------------|------------------|-------------------|
| Easements..... | 9.0 | 3.0 | 3.0 | 1.5 | 1.5 |
| Rentals..... | 10.0 | 3.5 | 3.5 | 1.5 | 1.5 |
| Total..... | 19.0 | 6.5 | 6.5 | 3.0 | 3.0 |

Recreational Opportunities in Agricultural Programs.—Recreational facilities can provide additional income to people in rural areas and permit diversion of some land to more beneficial public uses. To promote these aims, consideration of the following program is proposed:

1. Federal cost-sharing, credit, and technical assistance would be provided to local organizations under the Watershed Program for acquiring lands, easements, and rights-of-way, and installing basic recreational facilities in conjunction with selected watershed reservoirs and along streams, lakes, marshes, or other water areas for recreation, wildlife, and open space. Special attention should be given to flood plains which would be difficult or expensive to protect. Shifting the land to uses that do not require flood protection would be an alternative to high-cost flood control works. The reservoirs, lands, and recreational facilities would be operated and maintained for public use by the local sponsoring organizations.
2. Farmers should be given technical assistance, cost sharing, and credit to help them develop ponds, hunting, fishing, and other recreational facilities, preferably in conjunction with balanced farm plans.
3. Where the lands in the agricultural use adjustment program are adjacent to urban areas, consideration should be given to local plans for open space. Cooperation would be offered to local governments in planning and developing rural lands as open space. The activity would be coordinated with the open space program of the Housing and Home Finance Agency.

Relation of Land-Use Adjustment Program to Local Plans.—Maximum use should be made of activities and programs concerned with watershed projects, soil conservation districts, conservancy districts, drainage districts, irrigation districts, mutual irrigation companies, river basin planning, rural area development, and other regional, State, and local organizations with which the Department cooperates. The objective should be to achieve maximum local and regional benefits in addition to national objectives of balanced land use.

The Department should seek cooperative arrangements with States and with other Federal agencies that will contribute to the land-use adjustment, development, and planning needs set forth in this report. Cooperating farmers and organizations should be expected to con-

form with State laws and with zoning ordinances and other official regulations governing land and water development.

Land and Water Conservation and Development

Soil and Water Conservation.—An estimate of the cost of soil and water conservation practices needed on non-Federal rural land was made by applying current costs to data from the recent USDA Conservation Needs Inventory.

Measures included are those which experience shows are likely to be used in meeting the types of conservation problems inventoried. Some land treatment measures will need to be applied more than once during the next 20 years on some of the lands involved. Costs were not included for maintenance and are therefore limited to initial and repeat applications. This estimate takes into account only the direct costs of materials, labor, and rent of equipment. Such indirect costs as the loss of income or the deferment of income from the land due to the application of the conservation measures are not included.

On the basis of the foregoing, a total private and public investment of approximately \$50 billion would be required if the conservation needs shown by the U.S.D.A. Inventory are to be met. About \$33 billion would be required for conservation practices on cropland to solve problems caused by erosion, excess water, unfavorable soils, or adverse climate. Approximately \$10.5 billion would be needed for conservation measures for establishment and improvement of pasture and range. About \$6 billion would be necessary for establishment or improvement of farm woodland and commercial forests.

The rate at which the needed conservation practices will be applied depends largely upon three factors: First, the extent to which public assistance programs are available to reduce the share of the total cost that the landholder otherwise would be required to bear; second, the extent to which landholders have a favorable balance of income over costs of operation to invest in conservation; third, the extent to which technical assistance (including soil surveys) is available. Past experience indicates that landholders assign a low priority to conservation investment in relation to some of their immediate operating costs. There is no indication that this will change.

The benefits to be derived from meeting the Nation's conservation needs cannot be completely measured in monetary terms. Farmers benefit from the resulting continued productive capacity of their land. The entire Nation benefits by maintaining our basic soil and water resources. Conservation will mean that in the long run as a Nation we will pay less for our food and shelter. The projected crop yields used in the analysis of future productivity are based on the assumption that application of conservation practices over the next 20 years will be at the rate experienced in the 1950 to 1960 period.

The current value of farmland exclusive of buildings has been estimated at \$110 billion. The estimated conservation costs are mainly for the protection and maintenance of the productive capacity of this farmland. If the conservation practices included in the Conservation Needs Inventory were applied over a 20-year period, the average annual conservation expenditure of \$2.5 billion would equal nearly 10 percent of present annual farm operating costs. Such a projected annual conservation expenditure, moreover, would be about 20 percent of the current net income from farming.

Currently about 4 to 6 percent of net farm income is being invested in soil, water, pasture, and forest conserving measures. Over 60 percent of these measures are accompanied by Federal cost-sharing, for which the Federal share is slightly less than one-half the total cost.

The current annual conservation investment is estimated at \$750 million, of which about 30 percent is Federal and 70 percent is non-Federal. Most of the non-Federal investment is by individuals. These estimates do not include forest conservation measures carried out by the timber industry.

Unless a greater portion of farm income than at present can be channeled into conservation investment, a billion-dollar increase in net farm income would yield at most a \$60 million increase in conservation investment. Therefore, increased income alone cannot be relied upon to achieve an annual investment in conservation comparable to what is estimated to be needed.

The public has a great interest in maintaining the Nation's basic resources and could ill afford not to bear the cost if no alternative existed. Experience shows, however, that landholders can and will bear a reasonable part of the cost. Experience also shows that farmers will better use and maintain the needed conservation practices if they have a direct investment in them.

It appears that the attainable rate of public and private investment during the next 20 years would meet about one-third to one-half of the estimated cost of conservation needs. Programs for conservation should continue to be reviewed with the objective of securing the greatest benefit from the investment of limited public and private funds.

Small Woodland Development.—About 391 million acres or three-fourths of the Nation's commercial forest land is in State, industrial, farm, and other non-Federal ownership. More than 90 percent of this area is in private ownership and two out of every three of these acres are in small private holdings. Cooperative Federal-State forestry programs are therefore largely directed to helping these small private forest landowners plant, grow, protect, and market their timber.

Cooperative State and private programs are well-established and represent impressive efforts of long standing. Although upward trends in independent reforestation and timber-stand improvement plus stepped-up cooperative Federal-State-private forestry programs should achieve noticeable improvement in the timber situation on small private holdings, it is clear that much greater accomplishment is needed to increase the productive condition of small holdings sufficiently to insure adequate future timber supplies for the Nation.

The Department is now engaged in preparation of a comprehensive program to accomplish needed improvements on the 257 million acres of commercial forest land in farm and other small private ownerships. The backlog of needed work that has gradually developed on small private woodlands in past decades in millions of acres is: complete reforestation, 40.7; partial reforestation, 10.0; and timber stand improvement, 96.3. Most timber cutting on these lands has been and is still done without regard to even minimum standards of forestry practices. Losses from fire and pests are still far above acceptable levels.

Insufficient continuity of management, unfavorable economic factors, and lack of motivation are examples of other problems to be overcome.

Watershed Installation.—Watershed projects provide an opportunity for integrating Federal assistance with local plans and objectives. Whenever overall river basin plans are available, the objectives of watershed projects will be made consistent with such plans.

The Soil and Water Conservation Needs Inventory shows that small watersheds containing about 1 billion acres have land and water problems requiring watershed planning and action for their solution. About one-third of the needs inventoried can be met in the next 20 years. This would require inclusion of 333 million acres in watershed projects under construction or completed by the end of the period, including 55 million acres in currently authorized projects with treatment completed on about 18.5 million acres.

The additional acreage proposed for inclusion in projects is:

[Million acres]

| Unit | 20-year pro- jection | First 5 years | Second 5 years | Third 5 years | Fourth 5 years |
|-------------------------|----------------------------|------------------|-------------------|------------------|-------------------|
| Watershed projects..... | 314.5 | 48.5 | 80.0 | 92.0 | 94.0 |

Based on benefit and cost estimates for 289 work plans authorized for operations on January 1, 1961, it is estimated that the projects will yield about \$2 of benefit for each dollar of cost. These benefits accrue to a very wide segment of the public. They include reduction in damages from floodwater and sediment; increases in net income from changed or more intensive use of property; increase in net income as a result of drainage and irrigation; savings in the cost of water treatment resulting from the reduction of sediment in industrial, municipal, and domestic water supply; and value of municipal and industrial water supply to be furnished by the project.

Certain other benefits not readily evaluated in monetary terms will accrue, such as improved business opportunities in the watershed, prevention of loss of life, enhancement of fish and wildlife resources, recreational opportunities, and water quality control.

National Forest Development.—Expanded development work is needed on the National Forests and Grasslands so that these public lands will meet their full share of present and future needs and keep pace with population growth and national economic development. A "Development Program for the National Forests" was transmitted to the Congress by President Kennedy in September 1961. This program includes all the renewable resources of the National Forest System—water, timber, recreation, forage, and wildlife habitat. It includes both long-term proposals to the year 2000 and specific proposals for the next 10 years. The program will be carried out as rapidly as possible within the overall budgetary requirements and financial resources of the Federal Government. The following paragraphs briefly highlight this program.

National Forest Watersheds will be protected and rehabilitated by soil stabilization and management to maintain or improve water quality and quantity.

The long-range timber goal for the National Forest System is an annual harvest on a sustained-yield basis of 21.1 billion board-feet of sawtimber by the year 2000. The program proposes to increase the harvesting to reach an annual cut of 13 billion board-feet by 1972.

The planned development and management of the 60 million acres of rangeland in the National Forest System will provide increased forage. Range improvements and intensive management will be combined with adjustments in numbers of livestock or seasons of use as necessary.

The growth and development of the Nation has had a great impact on the National Forests in increased use of their recreation resources. It is estimated that this use will rise from the 102 million recreation visits of 1961 to 195 million visits by 1972. Scheduled activities include improvement of existing campgrounds; planning and developing new campgrounds and picnic sites; and planning and developing swimming, boating, winter sports, and public service sites.

The National Forest Wilderness System includes 83 areas totaling 14.4 million acres. Of these, 14 are Wilderness areas, 30 are Wild areas, 38 are Primitive areas, and one is the Boundary Waters Canoe Area in northern Minnesota. These areas will continue to be managed to protect and preserve the primitive environment for people seeking wilderness recreation.

One-quarter of the recreation visits to the National Forests and Grasslands are for the primary purposes of hunting and fishing. Habitat must be made fully productive to support fish and game populations needed for public use and enjoyment.

Protection of National Forests from fire, insects, disease, weather, and destructive animals is also a task of major proportions. Better facilities and techniques for fire control and for more resources to cope with critical fire periods are programmed. Insect and disease control will be increased to a level that will substantially reduce the occurrence of large infestations.

A well-maintained system of forest development roads and trails is scheduled to meet production and service needs.

Within many units in the National Forest System the pattern of landownership is quite irregular. The long-range need is to acquire, by exchange or purchase, about 720,000 acres in key tracts to facilitate public recreation use of National Forest land. Additional purchases of about 7 million acres are needed, primarily in the East, to facilitate administration and development.

Construction and maintenance of administrative and fire control improvements are needed. For example, the increasing use of aircraft will require an additional 25 landing fields, reconstruction of 37 existing fields, and construction of 1,820 heliports and helispots.

Direct financial revenues from the National Forest System are expected to rise to about \$230 million annually by the time the 10-year development program is completed. However, the real benefits of this development program will accrue during the years ahead in satisfying the many and increasing demands upon this particular national resource.

Land Consolidation and Redevelopment.—Farm people who move away from rural areas have left idle land and unused buildings on

thousands of small tracts in low-income rural areas. Many of those tracts are held as a form of security by families with insecure off-farm work. Other tracts that are virtually neglected provide residences for ex-farmers who are engaged in nonfarm work or who are retired. Still other low-income farmers continue to eke out an existence on tracts improperly managed or too small to provide an adequate family income. This situation calls for positive assistance in redirecting the use and management of small tracts, and in reorganizing them into tracts of economic sizes.

The low-income farm areas constitute about one-fifth of all the farm areas in the United States. The land operated per farm in these areas averages about one-third the size of farms in the higher-income areas.

Developing adequate farm units should be a specific goal of the Department of Agriculture. Concentrated attention should be given to this problem by the administrators of the Department's programs of credit, cost sharing, technical assistance, and education.

In addition, it is proposed that the credit authority of the Department be expanded to provide loans to local public corporations, organized by local people under State laws and vested with appropriate powers, through which the affected lands could be acquired for redevelopment and resale. The major activities of the corporations might be as follows:

1. Buying and reselling land for consolidation, land-use changes, and redevelopment. The activity could promote adequate family farms as well as forest, recreation, industrial, and other developments.
2. Buying and organizing a number of adequate farm units on which qualified farm families could progress toward ownership while operating under a long-term lease.
3. Buying or exchanging lands to be leased out. Some leases could contain option to buy. The corporation leasing of scattered tracts would be used largely to supplement inadequate farms; or to change or add enterprises on existing farms.
4. On an experimental basis, some lands might be sold under flexible financing arrangements, such as repayment schedules based on income.

Administration of this program would be coordinated with credit and other rural development programs. As is now done with grazing districts, some lands could be locally administered subject to general rules of the public corporation or agency responsible. Appropriate coordination of Federal, State, and local government would be necessary.

A large proportion of the costs of land purchase and redevelopment could be recovered through resale or rental of land not reserved for public use. Benefits would be primarily in terms of efficiency of operation, improved farm income, value of improved timber and grass production, recreation development, improved community services, and increased tax returns from otherwise unemployed resources.

Based on past trends, the number of farms is expected to decline materially by 1980; this decline would be accompanied by drastic readjustments, economic dislocations, and maladjustment of resources. Thus, it would appear that there is a pressing need for land consolidation and redevelopment activity. However, at this time only a pilot

program is recommended, together with careful study and evaluation of the possible approaches to this problem.

Family Farm Improvement.—A major objective of the Department of Agriculture is to provide appropriate and needed services to preserve and improve the family farm pattern of American agriculture and to improve farm and rural living.

It would appear feasible to develop approximately 400,000 to 600,000 fully adequate family-farm units by 1980 from land and water resources that may become available through voluntary transfers. During this period, rural development, credit, and training should be provided to facilitate the shift of some farm families, who are now on farm units which do not provide a living and full employment, into other gainful occupations. High priority will be given to development of new opportunities in rural areas. This adjustment will benefit the families and permit needed adjustment in land use. It also will make additional resources available to farmers who remain in agriculture.

Families who are not able to leave their farms or to take nonfarm employment because of age, ill health, education, or personal preference, will be assisted to achieve the maximum rehabilitation possible.

While operator-ownership of farmland is to be encouraged, it is recognized that some family farmers will continue to be renters or part owners. Under some circumstances this may represent the most desirable tenure position for them. However, the program of loans for farm ownership by qualified farm families should be accelerated.

Loans and grants should be extended to improve housing for owners, tenants, hired labor, and migratory workers on farms.

Credit, research, and technical assistance should be focused on providing modern electric, domestic water, and communications services to meet the needs of agriculture and improve farm and rural living.

Based on past experience, it is estimated that about 94 percent of the funds required for these programs would be recovered with interest. The remainder would cover administrative costs and losses.

Land and Water Use Planning

Farm and Ranch Planning.—Individual farm and ranch soil and water conservation plans are the backbone of assistance to soil conservation districts by the Soil Conservation Service. Nearly all farms or ranches need planned conservation programs, based on sound technology, to guide their conservation progress efficiently.

The justification for providing technical assistance at public expense to individual farmers, ranchers, and other landowners, taking into consideration present national production needs, is (1) to assure the protection of productive agricultural land to meet future needs of the Nation, and (2) to help farmers and ranchers develop efficient use of soil and water resources.

The conservation plans that farmers and ranchers develop with this technical assistance are designed to (1) provide a high level of net income to the individual operator, (2) maintain the productive capacity of the land, and (3) enable each operator to use national farm adjustment programs effectively on his operating unit.

Soils differ greatly in their characteristics. Farmers and ranchers need assistance in recognizing the potentials and limitations of their

soils and the income possibilities of different land uses. The low incomes prevailing in some sections of the country and on many farms stem in part from attempts to use land for purposes beyond its potential. The Department should provide farmers and others with soil surveys, including land capability and other interpretations, and technical assistance.

Many operating units are too small to sustain a farm family, and many units have a large percentage of land unsuited for intensive agricultural production. Some of these, however, are well suited for other uses. In many cases, a combination of two or more farm units may be necessary to bring together appropriate land-water resources for an adequate family farm. Such adjustments generally require credit and financial management as well as land resource improvement.

The several action programs of the Department should be coordinated and adapted to the needs of individual farms and ranches. The time to accomplish such an objective is when long-range, as well as short-range, decisions are being made by those who own and control the land. To this end it is proposed that expanded technical assistance, cost sharing, and credit be extended to farmers for use in developing and applying their conservation plans on entire operating units. The preparation of a definite plan and schedule should take account of suitable alternative land uses and combinations of permanent conservation practices. Preference should be given loans and cost sharing predicated on a definite conservation plan in accordance with program objectives. This would not preclude assistance for selected practices to those unable to take advantage of a definite plan and schedule.

The following projection of future needs in the United States is based on (1) the number of tracts and acres already under conservation plans; (2) the estimate of conservation requirements on land still needing conservation treatment; and (3) the estimated revision of plans due to changes in land use, crops grown, or type and size of farming operations, and advances made in conservation farming methods. Each of these points has been considered in projecting national goals for the next 20 years. Changes in landownership, number and size of operating units, and national production requirements in the years ahead may affect the net results during any of the 5-year intervals.

To move ahead more rapidly on soil and water conservation on private land, it is highly desirable to raise the rate of planning to at least 200,000 farms and ranches annually, and to increase the number of plan revisions from 40,000 to about 100,000 annually.

While considerable progress has been and is being made in the application of needed soil and water conservation treatment to the land, the present rate is too slow to encompass the 80 percent of private lands needing conservation treatment by 1980. The present level of technical assistance for conservation planning and application of practices should be increased by at least 50 percent during the first 5-year period and another 30 percent during the second 5-year period—or about 80 percent above the 1961-62 level. With increased volume in the work and improved efficiencies, a continued reduction in unit cost of planning and application is expected.

The desirable goal for technical assistance to landowners and operators for conservation planning and the application of practices follows:

| Item | 20-year projec- tion | First 5 years | Second 5 years | Third 5 years | Fourth 5 years |
|---|----------------------------|------------------|-------------------|------------------|-------------------|
| Number of conservation plans (thousand)----- | 3, 650 | 750 | 900 | 1, 000 | 1, 000 |
| Number of plan revisions (thous- and)----- | 1, 425 | 225 | 300 | 400 | 500 |
| Total (thousand)----- | 5, 075 | 975 | 1, 200 | 1, 400 | 1, 500 |
| Acres (million)----- | 1, 068 | 222 | 264 | 292 | 290 |

Conservation plans are prepared with technical assistance for farms and ranches, suburban tracts, rural residences, private timber holdings, and other tracts of land having soil and water problems. The projections were made with the expectation that about 80 percent of the acreage in private ownership should be included in preliminary conservation plans by the end of this 20-year period.

Revisions are necessary due to changes in acreage, consolidations of farms, and subdivision of larger holdings. Such adjustments in conservation plans should average 3 to 4 percent of the cumulative plans each year. Technical assistance is necessary to help each landowner prepare a conservation plan for the land he operates and to keep his plan up to date with advancing technology.

The estimated acres reflect the net increases during each 5-year period after adjustments for cancellations and other changes are made due to changes in land use, urbanization, highways, airports, reservoirs, and other nonfarm uses. This is the increased acreage for which technical assistance will be needed over a 5- to 8-year period in helping landowners design and install the planned conservation practices.

Technical assistance in conservation planning includes on-site help to farmers, ranchers, and other landowners; group enterprise systems for water management affecting several adjoining tracts; periodic revision of plans to reflect necessary changes; and the guidance needed to get planned soil and water conservation treatments properly installed on the land. Assistance to cooperating State and local agencies with program maintenance and improvement is also included. This phase of the conservation job on private lands is expected to increase substantially during the next 20-year period.

Watershed Planning.—Within the framework of available comprehensive river basin plans and in response to applications for assistance from local organizations, with approval by the States, detailed programs and plans are formulated for upstream watersheds to carry out the objectives previously described. Plan formulation and evaluation requires skilled and experienced technical specialists as well as knowledgeable and determined local leadership.

The estimates of planning requirements, including Federal funds needed, are based on the considerations previously stated that the maximum reasonable goal would be to meet one-third of the watershed

needs indicated by the Conservation Needs Inventory by the end of the 20-year period. Plans have been completed or are underway on 400 watersheds. Plans would be required on 5,200 additional watersheds to meet the goal for the 20-year period. The additional projects estimated to be planned in each of the 5-year periods follow:

| Unit | 20-year projec- tion | First 5 years | Second 5 years | Third 5 years | Fourth 5 years |
|-------------------------|----------------------------|------------------|-------------------|------------------|-------------------|
| Number of projects..... | 5, 200 | 800 | 1, 300 | 1, 500 | 1, 600 |

Comprehensive River Basin Planning.—Comprehensive river basin planning is concerned with the conservation and development of water and related land resources in both the upstream and downstream areas in river basins. The Department of Agriculture's participation involves determining and meeting the needs for agriculture (including forests and grasslands) in the basins and for municipal and industrial water supplies, power supply, flood protection, drainage, water quality control, and fish and wildlife enhancement and recreation in the upstream watershed areas. The Department develops information on needed land-use adjustments, soil and water conservation measures, and production requirements on all of the lands in the basin under the conditions that are expected to prevail in the future.

In his Special Message on Natural Resources, February 23, 1961, President Kennedy stated, "This Administration accepts the goal urged by the Senate Select Committee to develop comprehensive river basin plans by 1970, in cooperation with the individual States."

The development of integrated river basin plans will require participation by Federal, State, and local agencies. The present rate of planning falls far short of the goals for comprehensive river basin planning. It is estimated on the basis of the current schedule and at the scale of intensity of planning used in recent comprehensive river basin surveys, that during the next 20-year period comprehensive plans would be completed on one-half of the approximately 100 river basins remaining to be planned in the contiguous 48 States. Limitations on recruiting and training technical specialists and ability of non-Federal units of government to participate would need to be overcome if funds were provided for faster progress.

Soil Surveys.—Soil surveys have many uses such as: broad land-use planning; land-use adjustments; detailed farm, ranch, and watershed planning; land appraisal; tax assessment; highway engineering; urban-fringe planning and development; and agricultural research planning. Soil surveys are based on intensive study of our land.

Soil surveys include soil maps and appropriate text. The published text includes descriptions of the soils and of their productive capacity and potential uses. The hazards and limitations of each soil are given for each adapted land use. Rapidly changing interpretations, such as fertilizer recommendations and crop varieties, are given in frequently revised handbooks and State leaflets. Soil surveys show the location of soils suitable for cultivation and those not suitable.

Information is gathered about individual soils from research, experience of farmers and ranchers, field trials, laboratory studies, and other sources. Estimates of proposed program accomplishments based on the rate that trained soil scientists are expected to be available follow:

| Item | 20-year projection | First 5 years | Second 5 years | Third 5 years | Fourth 5 years |
|-------------------------------|-----------------------|------------------|-------------------|------------------|-------------------|
| Millions of acres mapped----- | 1, 651 | 390 | 785 | 476 | ----- |
| Number of man-years----- | 51, 725 | 12, 225 | 16, 875 | 12, 625 | 10, 000 |
| Number of publications----- | 2, 816 | 257 | 634 | 800 | 1, 125 |

It is recognized that the above rate is slower than is desirable from the standpoint of the critical need for soils information. The program includes the revision of earlier surveys of approximately 80 million acres.

It is estimated that beginning in about 1975, a maintenance staff of approximately 1,150 soil scientists will be required to keep soil interpretations and soil mapping up to date and in line with new developments in agricultural technologies and to provide on-site technical assistance to conservation planning technicians and others.

It is estimated that about 10 percent of the cost of soil surveys will be borne by State and Federal agencies outside the Department of Agriculture, such as Bureau of Indian Affairs, Bureau of Land Management, and Land-Grant Colleges.

Research Program.—The entire research program of the Department in farm research, economics, marketing, utilization, nutrition and consumer use, farm electrification, and forestry should be greatly strengthened. Present levels of research activity in these fields amount to about \$120 million annually.

Within the research program projected, specific areas requiring increased emphasis are:

1. *Grass, browse, and harvested forage.*—The 1980 projection indicates a substantial need for more pasture, range, and harvested forage. Research should be increased on breeding grasses and legumes for large, vigorous seedlings; on high-yielding, vigorous, adapted, palatable, nutritious forage plants; and on disease and insect resistance. Also needed are studies on machinery for seeding, harvesting, pelleting, and handling forages to reduce labor costs and to preserve nutritive values of forages. Pasture and range research to develop suitable management systems for the many different types of vegetation, livestock, and game should be accelerated.

2. *Soil management.*—There should be expansion in basic research necessary to control wind and water erosion, and salinity; on soil properties, processes and management; on soil-water-plant relationships; on the interaction of fertilizer, water use, crop variety, pesticide use, and tillage and other management practices; and on efficient, economic, and sustained conservation farming. We also need more research on nutrition of animals and man as affected by properties of soils, plants, and climate.

3. *Hydrology and water management*.—An expanded program in basic and applied research in hydrology and water management is essential to achieve maximum beneficial use of our limited water resources. Research is needed on sedimentation, watershed hydrology, hydraulics of irrigation, drainage, and watershed protection; on water supply structures, channels, and facilities; on conservation of water supplies for agricultural use; on irrigation design principles, requirements and facilities; on moisture conservation on crop and range land; and on the management of forest and range vegetation to influence quantity, quality, and timing of water yield.

4. *Protection against diseases, insects, weeds, and other pests*.—We need expanded research on the development of more effective control methods against crop, livestock, household, and other pests—insects, diseases, weeds, fire, air and water pollution, and chemical residues. Basic research on biological and cultural control of insects and diseases, and on the nature of insect resistance to insecticides, especially on genetic resistance, is urgently needed. Methods for control of phreatophytes and of rodents; research on the population ecology of game species and of songbirds; and research concerning the habitats for game and fish are needed.

5. *Agricultural adjustment*.—More economic research on programs of supply management, and price and income support, and their effects on conservation and use of land and water resources, is needed. Basic research to develop models and methods and to evaluate probable costs and returns should be greatly expanded.

Expanded research on problems of agricultural adjustment should emphasize studies of land tenure; credit; aggregative analysis of the effects of new technologies; interfirm integration and specification buying; migrant labor; training and educational needs; economics of farm size; assembly, processing, and distribution of farm products; consumer acceptance and food habits; and alternate use of purchased and nonpurchased inputs.

More economic research on new crops, on new industrial products from agricultural raw materials, and the utilization research to make them feasible is needed.

6. *Low income farms*.—Research addressed to the special problems of low income farms should be expanded with emphasis on combinations of labor-intensive crops, especially grass farming with sheep and cattle, small fruits, vegetable ornamentals, poultry, feeder pigs, and replacement heifers; on machinery adapted to small fields, economical and flexible in use; on soil and water research adapted to soil-building in hill lands; on improved farm forestry; on wildlife habitats; on fish farming; and on housing and family living, including training in use of credit and income supplementation from recreation, game, and fish. Research is needed to assist in bringing low income farms to economic adequacy. Research is needed on utilization of low quality timber and little-used species, typical of farm forest properties, to aid in development of new and diversified industries and outlets for timber products.

7. *Resource economics*.—Economic studies to provide the bases for sound land and water resource policies and optimum land use adjustments should be further intensified. Types of analyses needed include: future requirements for resources, production potentials, and competition between uses; procedures for the formulation, evaluation,

and selection of development programs; equitable arrangements for sharing program benefits and costs; legal bases and organizational arrangements for implementing resource programs; and the application of management and conservation to maximize farm returns.

8. *Farm electrification research.*—More research needs to be conducted in the application of electric lighting and other radiation to animals, plants, seeds, and insects, and in new and more effective applications of electric energy to cut farm production costs, produce better farm products, and conserve human energy.

9. *Forestry research programs.*—Forestry research programs should be expanded to put forestry on a sound technological basis. Objectives of a comprehensive National Forestry Research Program prepared by the Department in 1961 include:

Improve planting stock and tree seed sources through genetics and develop methods of reforesting problem areas.

Improve land use practices to preserve favorable hydrologic conditions. Develop methods to promote snow accumulation, regulate streamflows, and increase infiltration into the soils.

Improve basis for estimating range productivity and safe stocking rates and for judging range condition and trend. Develop systems of management to increase or maintain desirable vegetation, to protect soil, water, and forage values.

Determine wildlife populations that can be supported by various vegetation types. Improve opportunity to coordinate wildlife production with timber growing, domestic livestock, and other uses of forests and rangeland.

Improve methods of selecting, developing, and managing forest areas for mass recreation use and determine characteristics of recreation demand.

Reduce man-caused fires and fire-starting potential of lightning storms and improve methods of planning and organizing fire control activities.

Improve methods of detecting and controlling insects.

Develop methods to reduce impact of disease upon the forests and upon wood products.

Improve wood products through more effective preservation and better seasoning, glues, and manufacturing practices and find profitable uses for unused woods and residues.

Improve all aspects of mechanization in forestry practices including logging, site preparation, road building, and primary processing.

Maintain basic inventory data and determine timber harvest, growth, quality, and prospective supplies and demand for wood products.

Analyze economic aspects of forestry practices on small ownerships and large public or private holdings.

Improve quality standards for buying and selling forest products and analyze economic aspects of improving net return from timber harvest on small forest properties. Strengthen local economies through increased use and development of their forest resources.

Construction of additional research laboratories and related facilities at many locations throughout the country is an essential part of the Department's forestry research program.

State Land-Use Plans.—More effective use should be made of the powers of both the Federal and State governments in managing land and water resources. There has been a trend to extend Federal programs directly to landowners through more or less nominal participation by local and State organizations.

The States possess enormous powers and concomitant responsibilities in the direction and control of land and water resources. A way needs to be found to utilize these powers and responsibilities in resource management programs together with the extensive specialized technical skill and the vast financial resources of the Federal Government. Federal programs can be administered so as to develop strong incentives for State and local participation. Frequently there is too little responsibility required from the cooperating State and local organizations. Their contributions often are little more than nominal and sometimes do not induce the help that should be expected from an interested partner or co-worker. Federal administrators could well pay more attention to the development of greater zeal through strengthening Federal, State, and local relations. Frequently, the sharing of responsibilities in program administration will produce large dividends. The various arrangements which the Department of Agriculture uses for local and State cooperation could be profitably reviewed and revitalized or modified as needs indicate.

A grant-in-aid program should be established to encourage States to prepare land and water plans that would supplement and advance USDA and other Federal programs. Included would be cooperative programs to develop improvements in water law and administration, stronger resource district organizations, rural planning and means of implementing the plans, land-use changes and the protection of developed areas, open space areas, transportation facilities, parks, wildlife areas, and other uses.

Several States are effectively administering strong programs pertaining to planning and management of natural resources. All States should be encouraged to do so. It is highly desirable that all Federal, State, and local resource use endeavors should fit into supplementing patterns. Plans to enable Federal, State, and local resource programs to complement each other could be placed into operation at a small percentage of the cost of the operating programs.

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